Technician's Manual

U.S. ARMY

MED. DEPT.

Service School, Medical Department
Brooke General Hospital
Fort Sam Houston, Texas

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U. S. Army. Brooke general hospital, Fort Sam Houston, Tex.

ANATOMY AND PHYSIOLOGY

ANATOMY AND PHYSIOLOGY

Introduction:

In order for the medical soldier to intelligently perform his numerous duties in connection with sick and wounded, it is necessary that he should understand something of the structure of the human body and the functions of its various organs.

Definitions:

Cell	- A cell is the simplest unit from which all living things are built up. Each cell has an outer membrane, cytoplasm and a nucleus.
Tissue	- A tissue is a group of cells, similar in origin, structure and function, together with substance between the cells.
Organ	- An organ is a group of tissues which are united together in one unit for the performance of a special function or work.
A system	- A system is a group of organs associated together to perform a special function. Nine systems are found in the human body. Their names with the functions of each are briefly expressed as follows:

Skeletal system	- Support.
Respiratory system	- To provide oxygen and to get rid of carbon dioxide.
Alimentary system	- To receive, digest and absorb the food which is to be used by the cells.
Muscular system	- Contraction which results in motion.
Vascular system	- Distribution of the body fluids to all the cells.
Excretory system	- To eliminate the waste products that result from cell activity.
Nervous system	- To control and insure coordination in the working of all the systems in the body. Contains the centers for all the sensations, intelligence, and thought that we recognize as the highest functions of life.
Reproductive system	- To insure the continuance of the race by the production of other beings.
Endocrine system	- Glands of internal secretion, these glands secrete certain chemical substances called hormones, directly into the blood stream which have to do with growth and development of the body.

It is important to remember that these different systems are closely interrelated and dependent on each other. While each forms a complete unit especially adapted for the performance of some function, yet that function cannot be properly performed without the assistance and cooperation of other systems. The most perfect skeleton is not capable of support unless assisted by the muscular and nervous systems. Any interference with the circulatory system also affects the work of the excretory system, etc.

Anatomy - Study of the structure of the body and relation of the different tissues and organs of the body to one another.

Physiology - Treats of the function of living bodies and use and activity of various organs in life.

Anatomical Position - Is the one in which an individual stands erect with arms at the sides and palms forward.

Dorsal - Refers to the back, where the vertebral column is located; ventral refers to the opposite, or belly-side.

Cranial - Refers to the head-end of the body; caudal refers to the opposite end.

Superior - Refers to the region of the body which is uppermost in the standing position; inferior refers to the opposite.

Anterior - Refers to the region of the body which is forward in normal progression; posterior refers to the opposite.

In man, cranial and superior are synonymous; dorsal and posterior are synonymous; ventral and anterior are synonymous; and caudal and inferior are synonymous.

Medial - Means nearer to the midline (midsaggital plane) of the body; lateral means farther from the midline of the body.

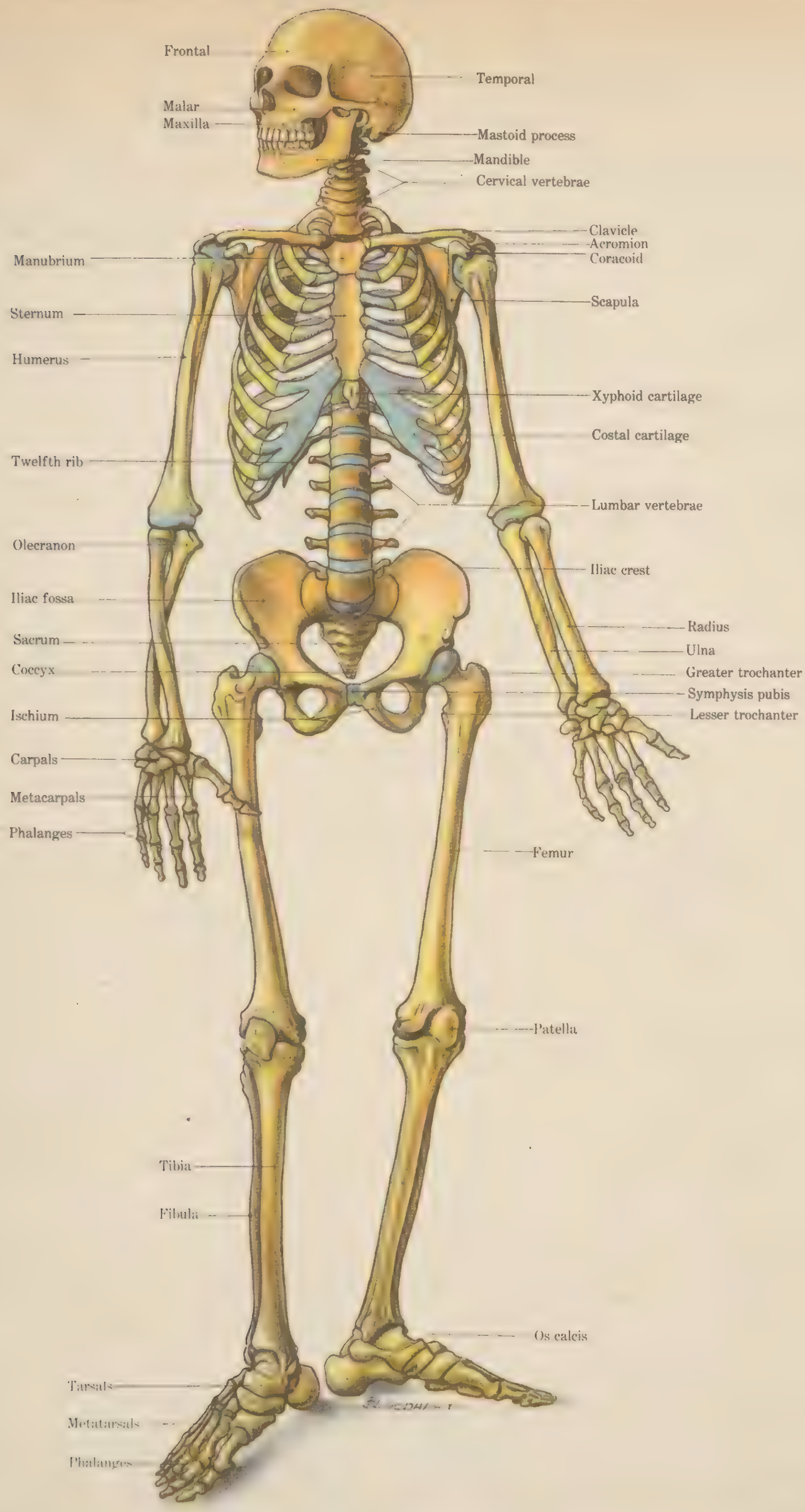
Internal - Refers to the center of mass of the part considered; external refers to the opposite.

Proximal - Means nearer to the source or point of attachment; distal means farther from the source or point of attachment. These terms are used only in connection with the extremities (limbs).

Central - Refers to the main or principal part, located internally; peripheral refers to the extensions from the main part toward the surface of the body. These terms are used principally in connection with the nervous system or circulations.

Parietal - Refers to the walls of a cavity; visceral refers to the viscus or organ in relation to the cavity.

Fundamental Planes - The body may be divided for convenience in description by the following planes: A saggital plane is one which passes from dorsal to ventral, and divides the body into right and left portions. The midsaggital or median plane divides the body into equal right and left portions. A transverse plane is one which passes crosswise through the body and divides it into cranial and caudal portions. A frontal plane is one which divides the body into ventral and dorsal portions.



THE SKELETON SYSTEM

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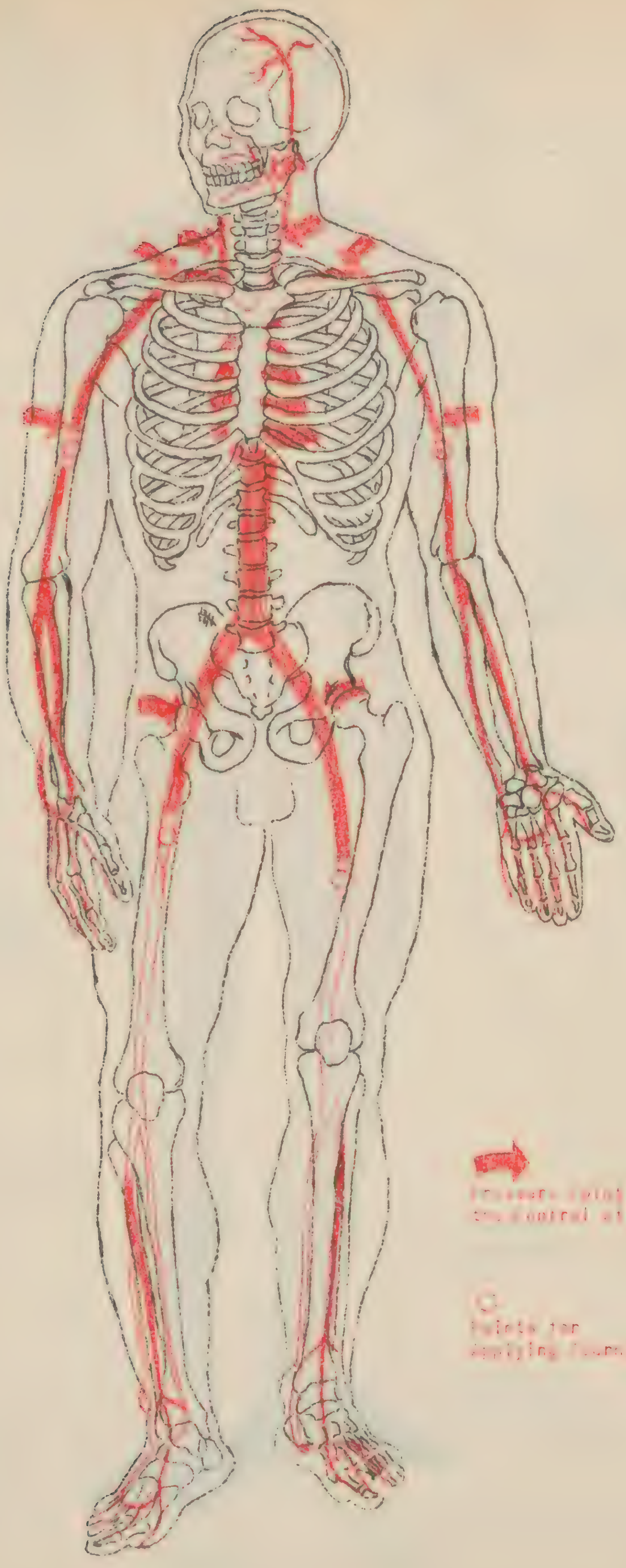
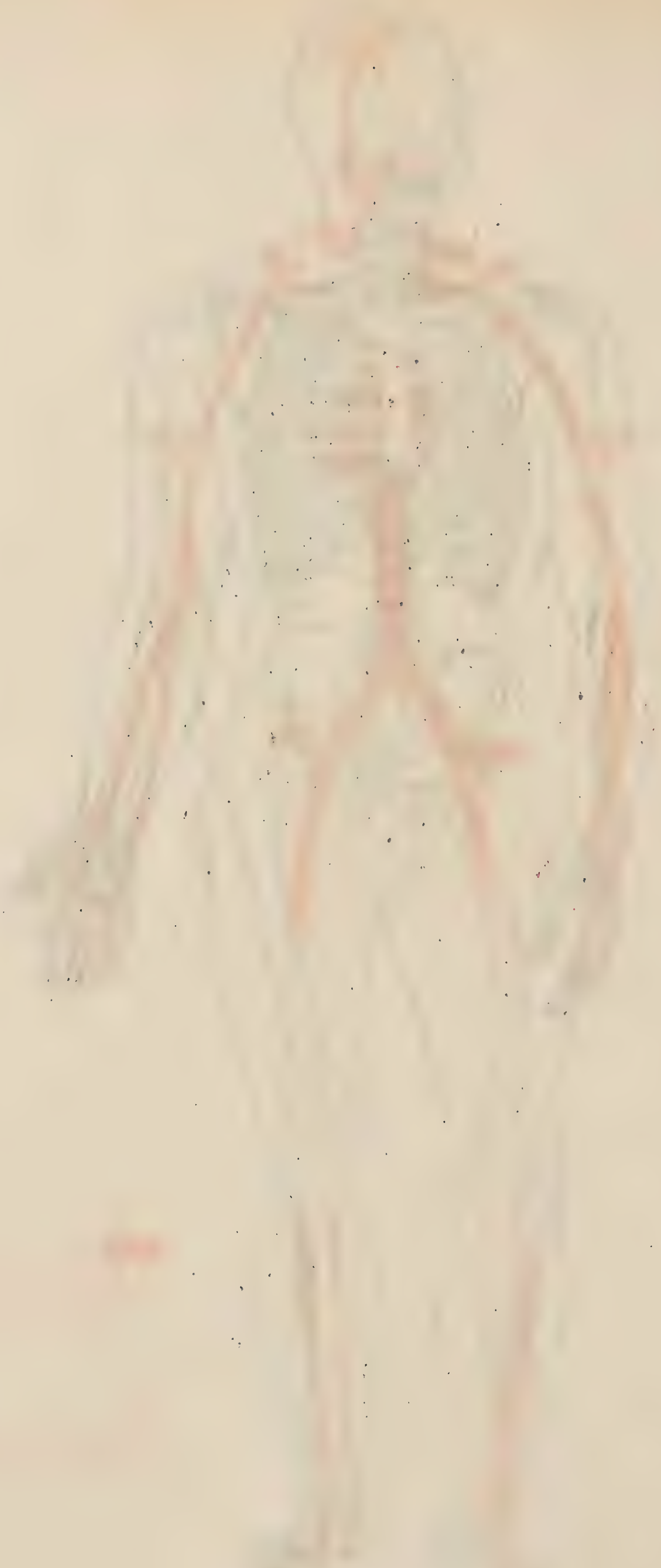
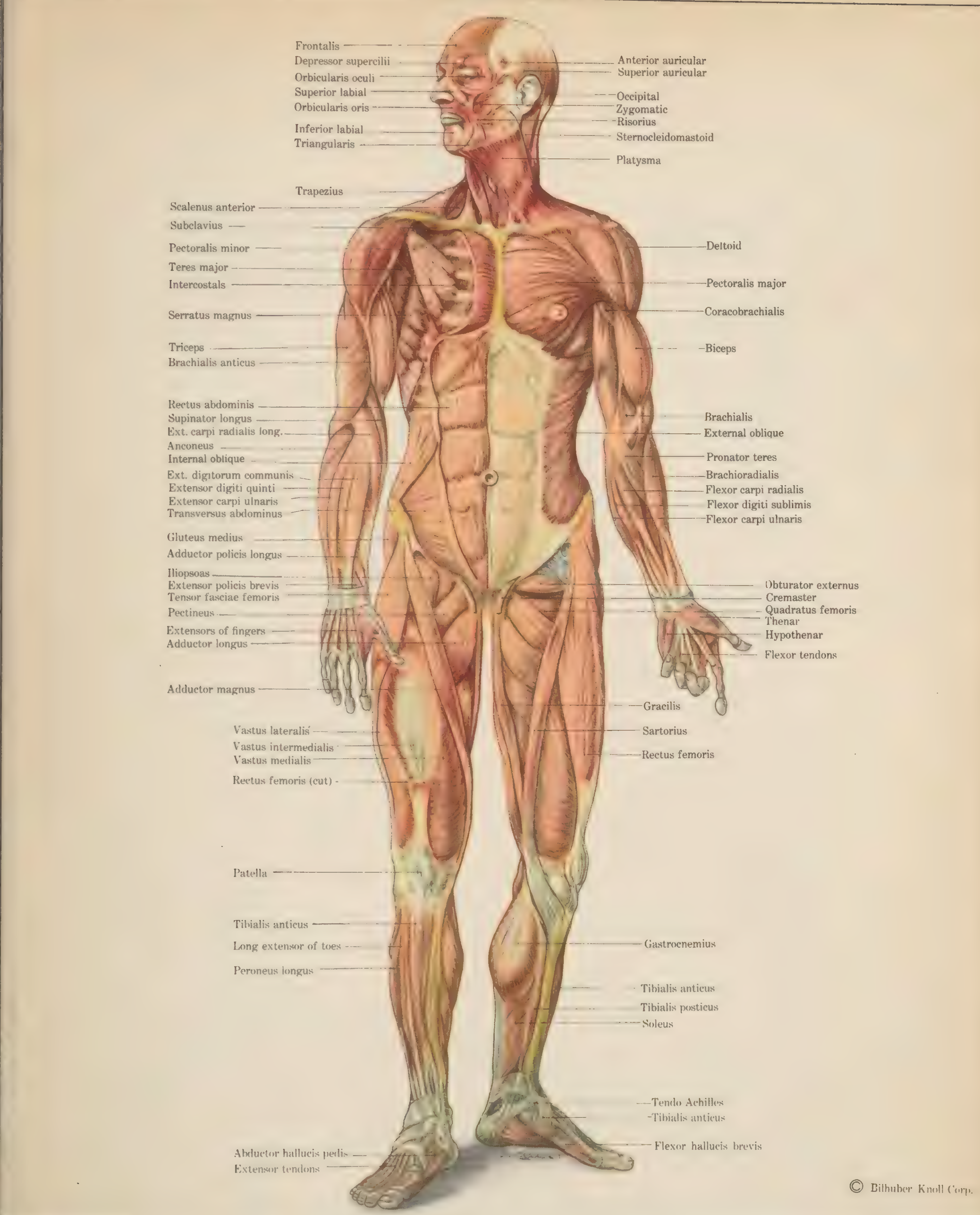


Pressure points for the control of bleeding

Points for applying tourniquet





THE MUSCLE SYSTEM

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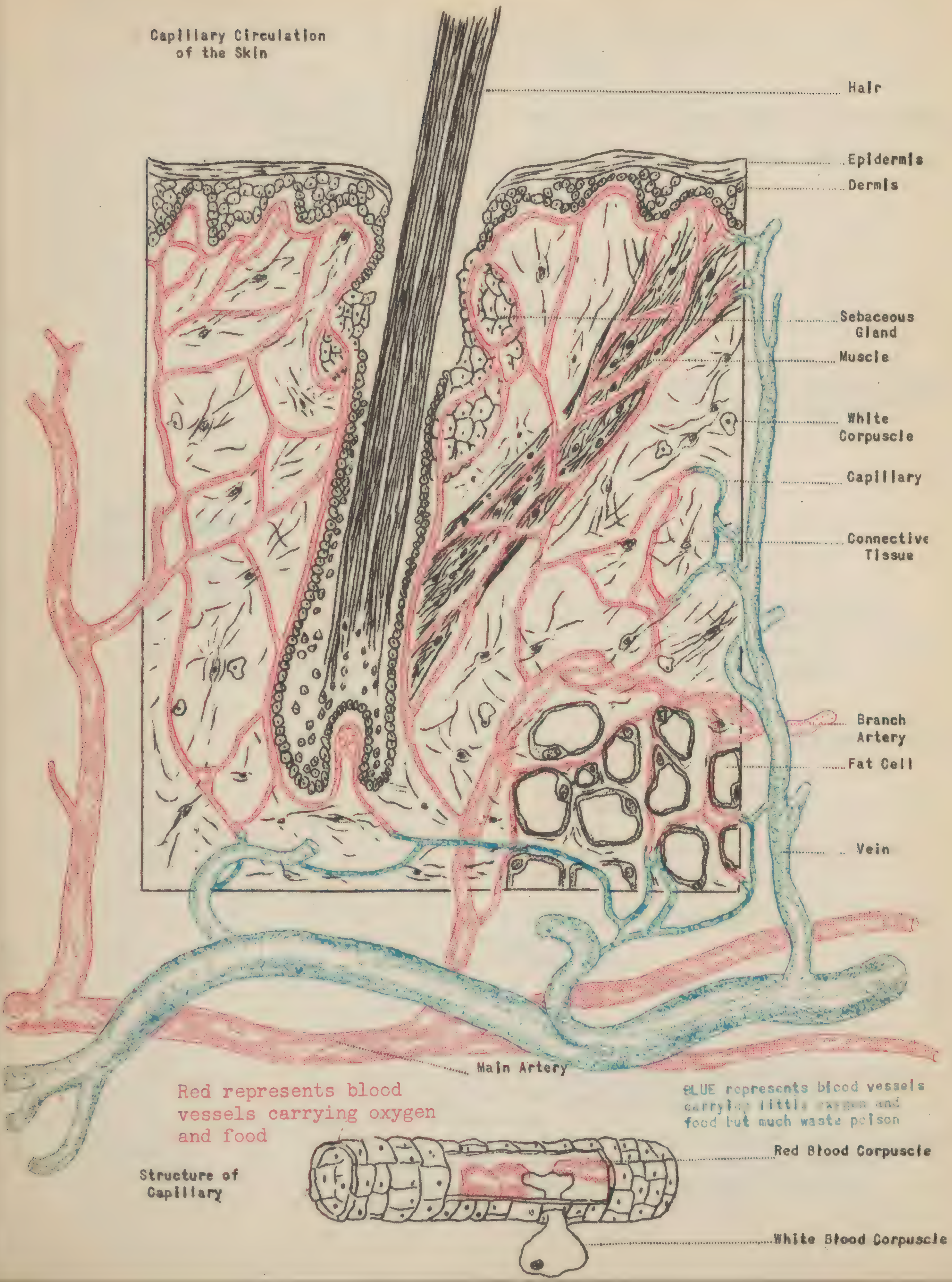
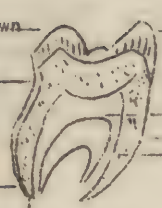

Capillary Circulation
of the Skin
Hair
Epidermis
Dermis
Sebaceous
Gland
Muscle
White
Corpuscle
Capillary
Connective
Tissue
Branch
Artery
Fat Cell
Vein
Main Artery
Red represents blood
vessels carrying oxygen
and food
BLUE represents blood vessels
carrying little oxygen and
food but much waste poison
Red Blood Corpuscle
Structure of
Capillary
White Blood Corpuscle

I. Skeleton - bony framework of body, gives shape, stability, protects organs.

A. Bones.

1. Composition - 1/3 animal matter - gelatin.
   2/3 mineral matter - lime.
   Bone end - cancellous and spongy.
   Shaft - compact and dense, contains marrow.
2. Covering - periosteum - nourishes the bone, loss of periosteum - death of bone.
3. Cartilage or gristle - elastic substance, covers ends of long bones, ends of ribs.
4. Number - about 200 without 32 teeth.
5. Classified.
   a. Long - femur, humerus.
   b. Short - tarsal, metacarpal.
   c. Flat - skull, pelvis.
   d. Irregular - pelvis, vertebrae.
6. Structure of Skeleton.
   a. Skull.
      (1) Cranium - contains brain, composed of 8 bones, frontal, occipital, 2 parietals, 2 temporals, ethmoid, sphenoid.
      (2) Face - 14 bones - Important are 2 nasal bones, 2 maxilla, 1 mandible.
      (3) Structures within skull.
         (a) Sinuses.
            (1a) Frontal.
            (2b) Ethmoid.
            (3b) Sphenoid.
            (4d) Maxillary.
         (b) Mastoid Cells - in mastoid bone behind ears.
         (c) Foramen Magnum - large hole in lower part of occipital bone - spinal cord connects to brain.



   b. Vertebral Column - back bone, or spine (vertebrae - separate bones in column).
      (1) Cervical (neck) - 7 support head.
      (2) Thoracic (chest) - 12, support ribs, chest and upper extremities.
      (3) Lumbar (back) - 5, support trunk.
      (4) Sacrum (Pelvis) - 5, support pelvis.
      (5) Coccyx (tail bone) - 4
      Through vertebral arches - passes the spinal cord, fracture of spine might injure cord.
   c. Thorax (chest).
      (1) 12 ribs on each side - come together in front to join sternum or breast bone.
      (2) 7 true ribs, 5 false ribs.
      (3) Sternum - breast bone - 3 parts; manubrium, gladiolus, xyphoid.
      (4) Clavicle - S shaped - helps make up shoulder and support of shoulder (collar bone).
      (5) Scapula - flat - helps to form shoulder, has glenoid cavity for head of humerus (shoulder blade).
   d. Army, forearm and hand.
      (1) Humerus - head - helps to form shoulder joint, through surgical neck, more easily fractured - lower end helps make up elbow joint. Surgical neck below tuberosities.

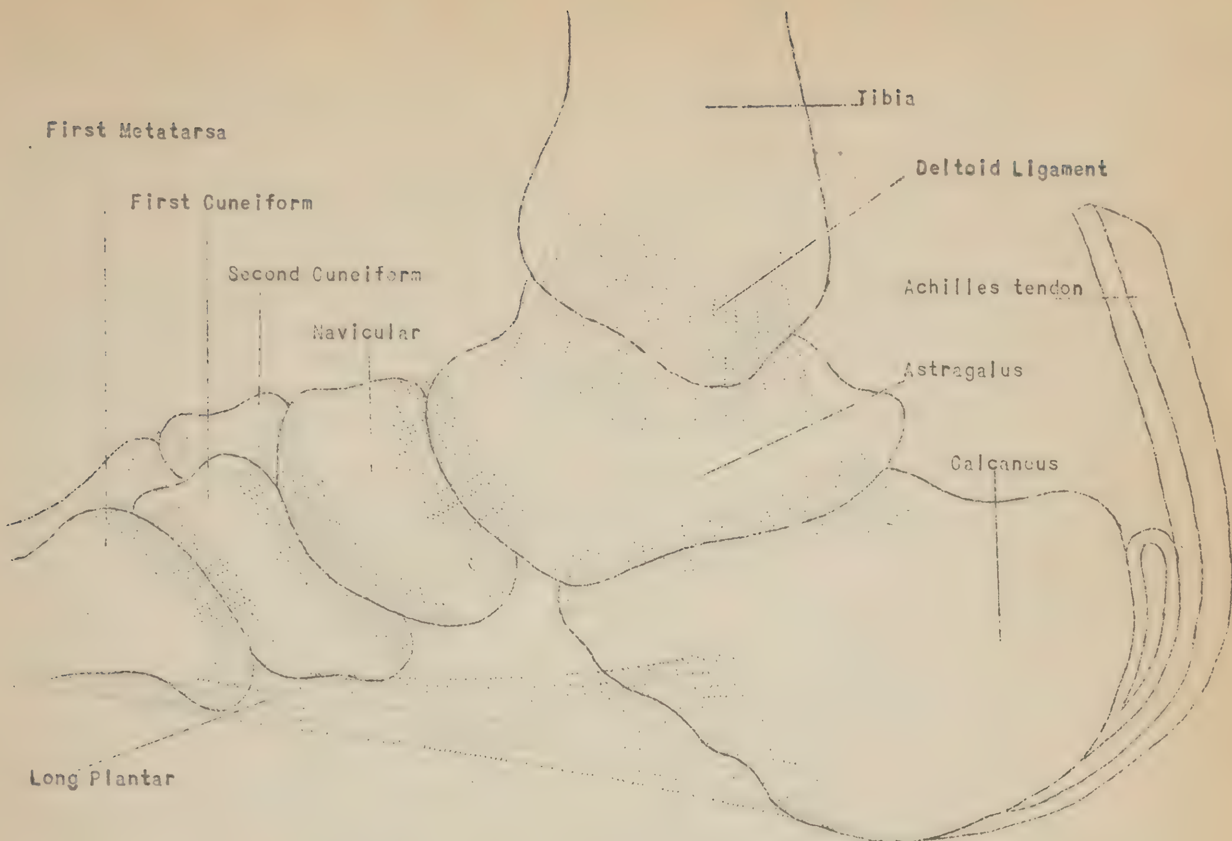
(2) Radius - Colle's Fracture above wrist joint, radius and ulna.
(3) Ulna - elbow - olecranon, help make up elbow and wrist joint.
(4) Carpus - wrist - 8 bones.
(5) Metacarpal - hand - 5 bones.
(6) Phalanges - fingers, 3 rows, except thumb has two.

e. Pelvis, or basin - 2 innominate bones and sacrum in back. Innominate bones made up of ilium, ischium and pubis.
f. Femur - longest bone in body (thigh); upper portion - head and pelvis make up hip joint - ball and socket joint. Low portion of femur, patella, and upper portion of tibia and fibula, make up knee joint.
g. Patella - knee cap.
h. Tibia and fibula - leg.
i. Tarsus, metatarsus and phalanges - foot.
j. Teeth - 32 permanent. 2 crops - milk and permanent.
   (1) Structure - enamel, dentine, cement, pulp.
      (a) 8 front teeth incisors.
      (b) 4 canine.
      (c) 8 bicuspid.
      (d) 12 molars (upper, 3 roots; lower, 2 roots).

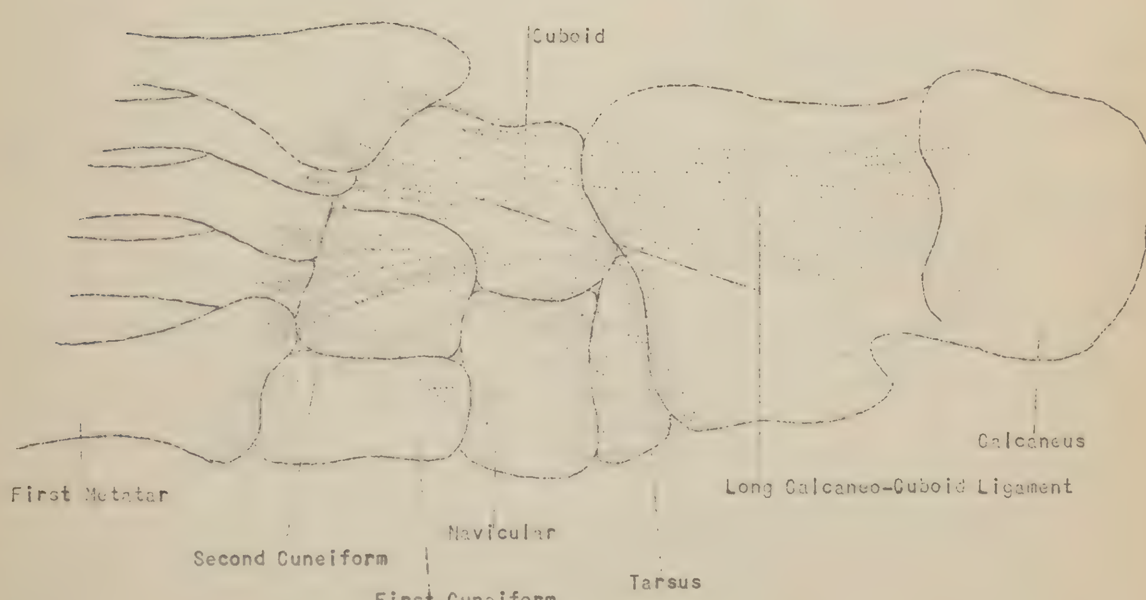
B. Joints - where 2 bones meet and move on each other. Ends covered with cartilage, enclosed by a joint capsule and lined with synovial membrane which is filled with fluid. Joint bound together by ligaments and strengthened by surrounding muscles. Ligaments are strong flexible bands, of fibrous tissue that help to hold bones together at the joints.
   1. Kinds.
      a. Ball and socket - shoulder and hip.
      b. Hinged joints - knee.
      c. Sutured - skull.
   2. Dislocations - bone ends of a joint misplaced and remain out of place. Sprain - (temporary dislocation) - muscles, ligaments and blood vessels are also torn.

C. Muscles - fleshy parts of body, main organs of motion. The muscles in their action upon the bones produce various special motions; bending a limb is called flexion, straightening it is extension; turning the palm down is pronation, turning it up supination; motion of the limb on its long axis is rotation. Abduction is throwing a limb out from the body, while drawing it toward the body is adduction.
   1. Function - to move various parts and tissue of body. Contract (shorten); relax (lengthen).
      a. Bone broken - muscle pull shortens bone, causes over-riding and deformity.
      b. Tendons - tapering end of muscle attaching to bone.
   2. Types
      a. Voluntary - sterno-mastoid, biceps, diaphragm.
      b. Involuntary - heart, intestines, bladder.
   3. Connective Tissue - connects together all other tissues and is support for blood vessels, nerves and fat.

D. Skin - tough, elastic membrane, covers entire body, continuous at various orifices with mucous membrane.



MEDIAL VIEW OF FOOT LIGAMENTS (RIGHT FOOT)



LIGAMENTS OF THE PLANTAR SURFACE OF THE FOOT

1. Layers.
    a. Epidermis - cuticle
    b. Dermis or Derma - true skin.
2. Derma - contains blood vessels, nerve, sebaceous and sweat glands.
3. Appendages of skin - hair and nails, modified cuticle.
4. Functions.
    a. Protection - bacteria, undue evaporation, injury.
    b. Receive nerve ends - organ of touch.
    c. Excretory - waste.
    d. Temperature regulator.
    e. Some power of absorption.

E. Circulatory System - includes the lymphatic system, blood and blood vascular system, and is concerned with onward and continuous movement of the blood and lymph.

1. Lymphatic system - lymphatic and lacteal vessels and lymphatic glands.
    a. Lymphatic vessels - like veins all over body have valves like veins - contain lymph (colorless fluid). Lacteals - lymphatic vessels about intestines (contain milky fluid during digestion.)
    b. Lymph glands - vary in size - filters for lymph before it enters blood; lymph enters blood by way of thoracic and lymphatic duct.
       Lymph glands - resist invasion of body by disease germs. Kernels or lymph glands found in arm pits, groin (bubo), etc.
    c. Lymph is fluid which comes in contact with tissues directly; it is the "middleman" between blood and tissues. Resembles blood in which red blood cells are few in number.
2. Blood - red in color. Bright red in arteries. Dark red in veins.
    a. Fluid - 1/20 to 1/14 of body weight, $1\frac{1}{2}$ gals. to body plasma and cells or corpuscles.
        (1) Cells
            (a) Red - 4 to 5 million to cub. millimeter - flat disc, concave sides, oxygen carrier. Are formed in red bone marrow.
            (b) White - 7 to 8 thousand to cubic millimeter - round, scavenger.
                (1a) Non granular leukocytes are lymphocytes and monocytes formed in Lymphoid tissue.
                (2b) Granular leukocytes originate in red bone marrow.
                Leukocytosis increase in white blood cells.
                Leukopenia a decrease in white blood cells.
            (c) Platelets - necessary for coagulation, 250,000 to cubic millimeter.
        (2) Plasma - serum and fibrin.
            (a) Serum - contains nourishing elements of blood, - albumin, fats, sugar, salts and gases.
            (b) Fibrin - aids clotting - normal clotting time 3 to $3\frac{1}{2}$ minutes.
    b. Functions
        (1) Carries nutrition and oxygen to tissues of body.
        (2) Removes waste products of tissues.
        (3) Protects against bacterial invasion.
        (4) Maintains proper temperature and moisture of body.

3. Heart - conical hollow muscle, lying between lungs and behind sternum, enclosed in fibrous sack - pericardium. Size of fist; weight, 3/4 lb. - apex at 5th interspace. Divided in 4 chambers, 2 auricles and 2 ventricles. Right side - venous, left, arterial.

Systemic circulation - in order to maintain a constant circulation of the blood, a complete system exists, constantly acting pump, the heart, arteries carry blood to all parts of body capillaries deliver the blood to tissues, and take up waste products into veins, which return the impure blood to the right side of heart, 1/2 minute for entire trip.

Subsidiary system, known as pulmonary circulation, where arteries take impure blood from right side of heart to lungs, into capillaries. Here it is purified, losing carbonic acid and waste matters and takes on a load of oxygen and passes through the pulmonary veins to left side of heart, then the systemic circulation.

Coronary circulation - heart muscle derives its blood supply from the right and left coronary arteries arising just above the origin of the aorta from ascending portion of the arch.

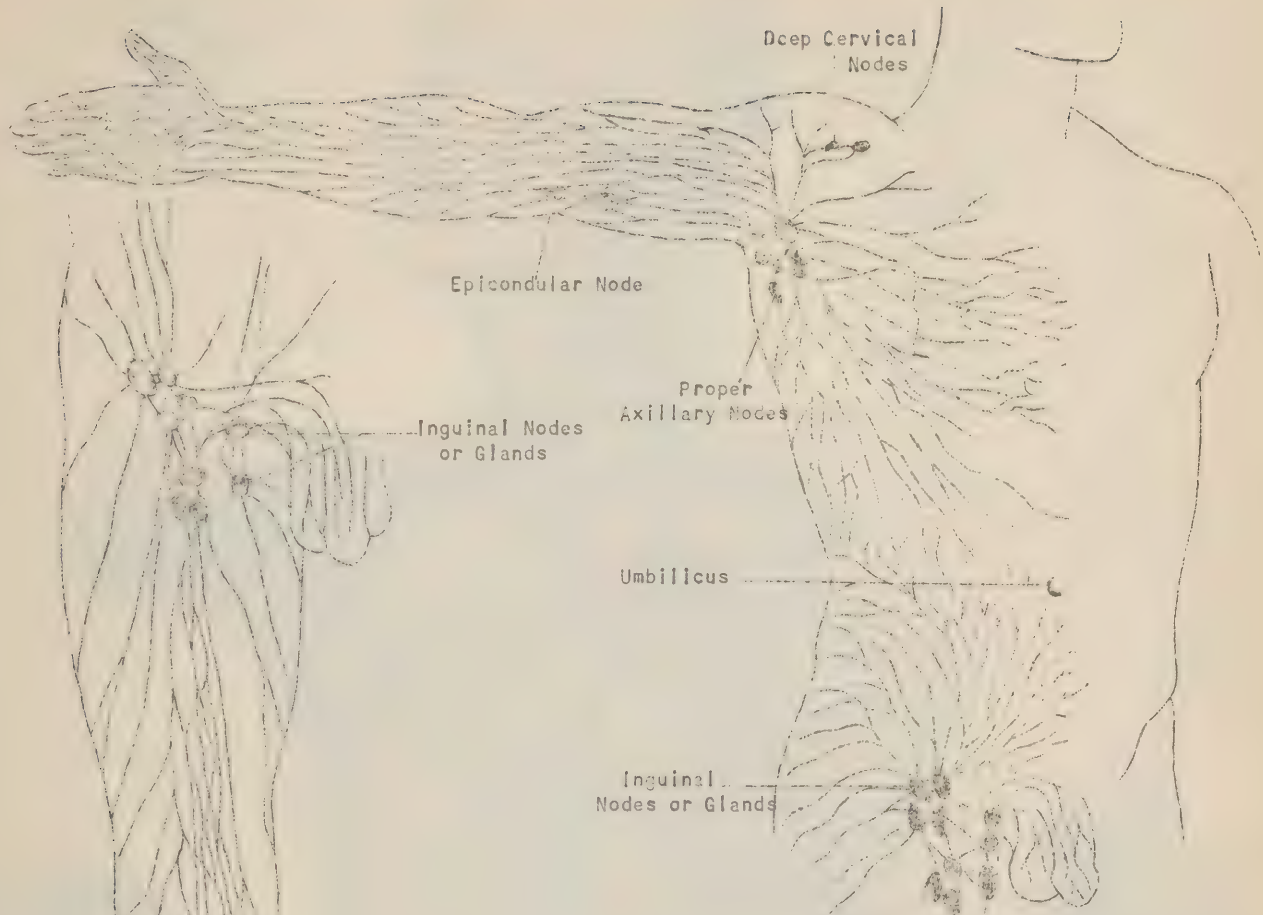
a. Valves.
   (1) Mitral - between left auricle and left ventricle.
   (2) Aortic - lies between left ventricle and aorta.
   (3) Tricuspid - between right auricle and right ventricle.
   (4) Pulmonary - from right ventricle.

   Heart rate - 60-80 adults; children and infants - 100 to 130.

4. Vessels.
   a. Arteries - carry blood away from the heart - elastic, muscular tubes, thick walls, without valves, have pulsation, lie deep, (blood from cut artery spurts and is bright red), freely communicate and branch freely, thus arteries become gradually smaller to terminate in capillaries.
   b. Capillaries - resemble minute hairs and serve an interchange between blood and tissue and then to veins.
   c. Veins - carry blood to the heart - thin wall, no elasticity, with valves, blood dark red, flows in continuous stream, veins superficial. Veins obstructed, result - enlarged veins - varicose veins in leg, scrotum varicocele, about anus, hemorrhoids or piles.
      (1) 3 sets.
         (a) Pulmonary veins - convey arterial blood from lungs to heart.
         (b) Systemic - deep - accompanies arteries. Superficial - under skin.
         (c) Portal - 4 large veins collect the venous blood from the viscera of digestion through liver via hepatic vein to right auricle.

F. Respiratory System.

I. Composition - consists of larynx, trachea, bronchi, lungs and accessory passageways - nasal cavity and pharynx.
   a. Nasal Cavity - divided into right and left parts by nasal septum; septum composed of cartilage anteriorly and bone posteriorly, is separated from mouth by palate. The cavity is divided into meatuses by nasal turbinates. There are 3 turbinates and 3 meatuses on each side of the nose.



LYMPHATIC SYSTEM OF TRUNK, GENITALS AND UPPER LIMBS

LYMPH NODES AND VESSELS OF LOWER LIMB

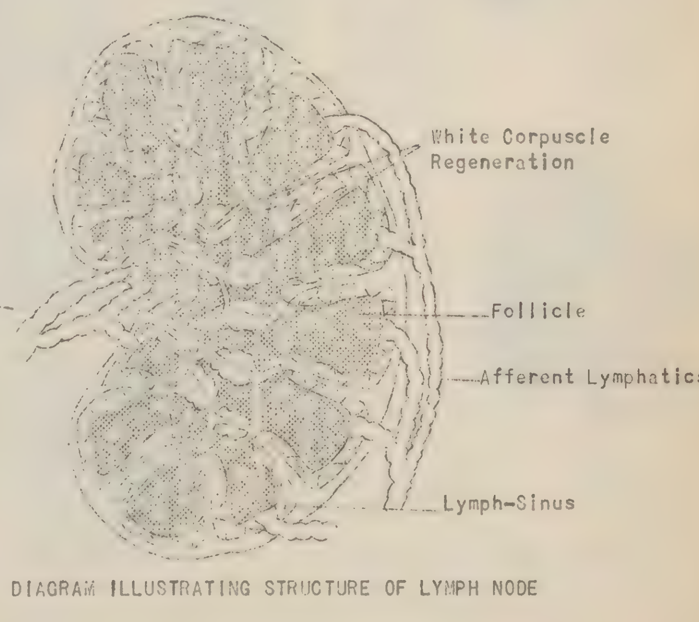
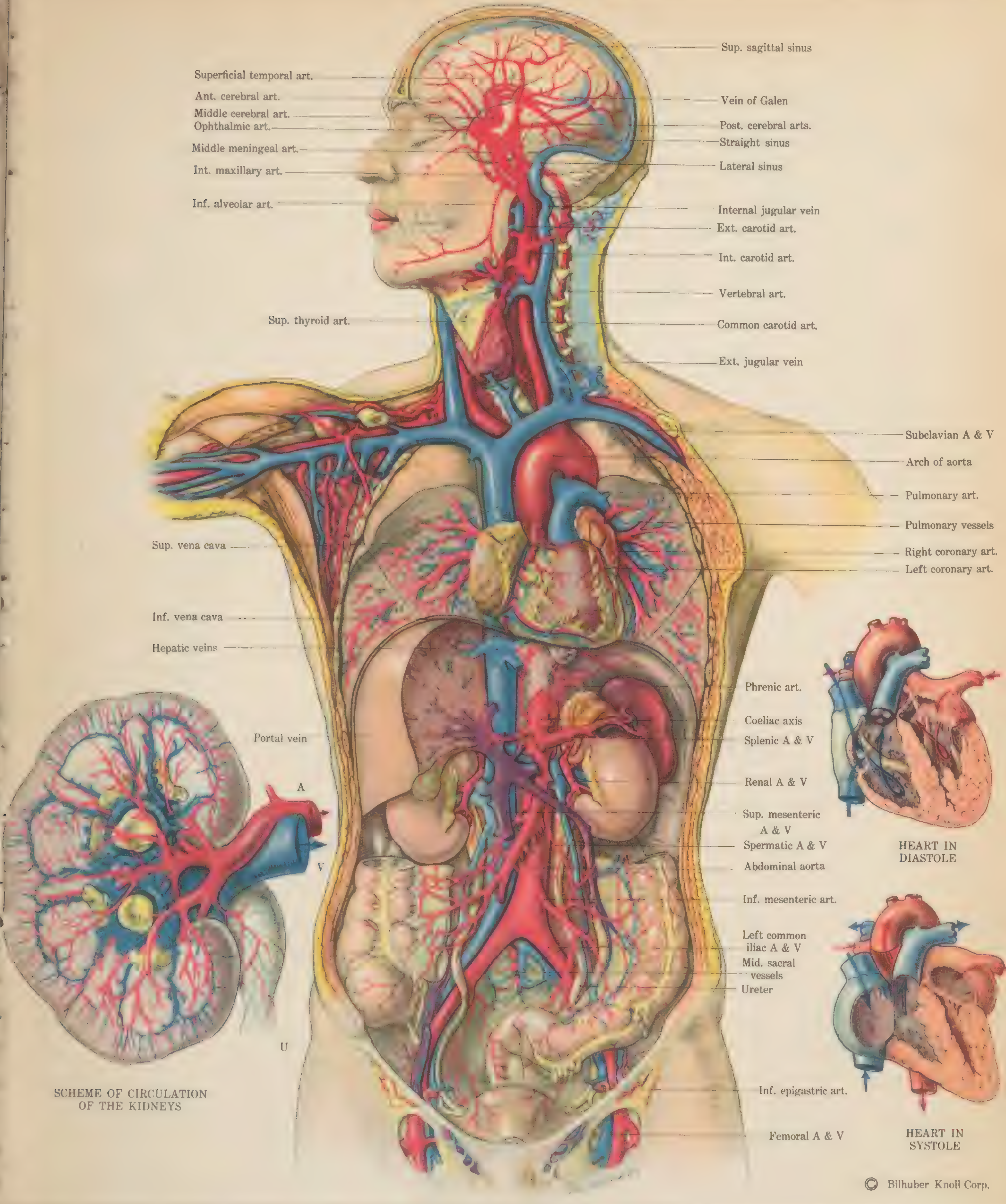


DIAGRAM ILLUSTRATING STRUCTURE OF LYMPH NODE



THE CIRCULATORY SYSTEM

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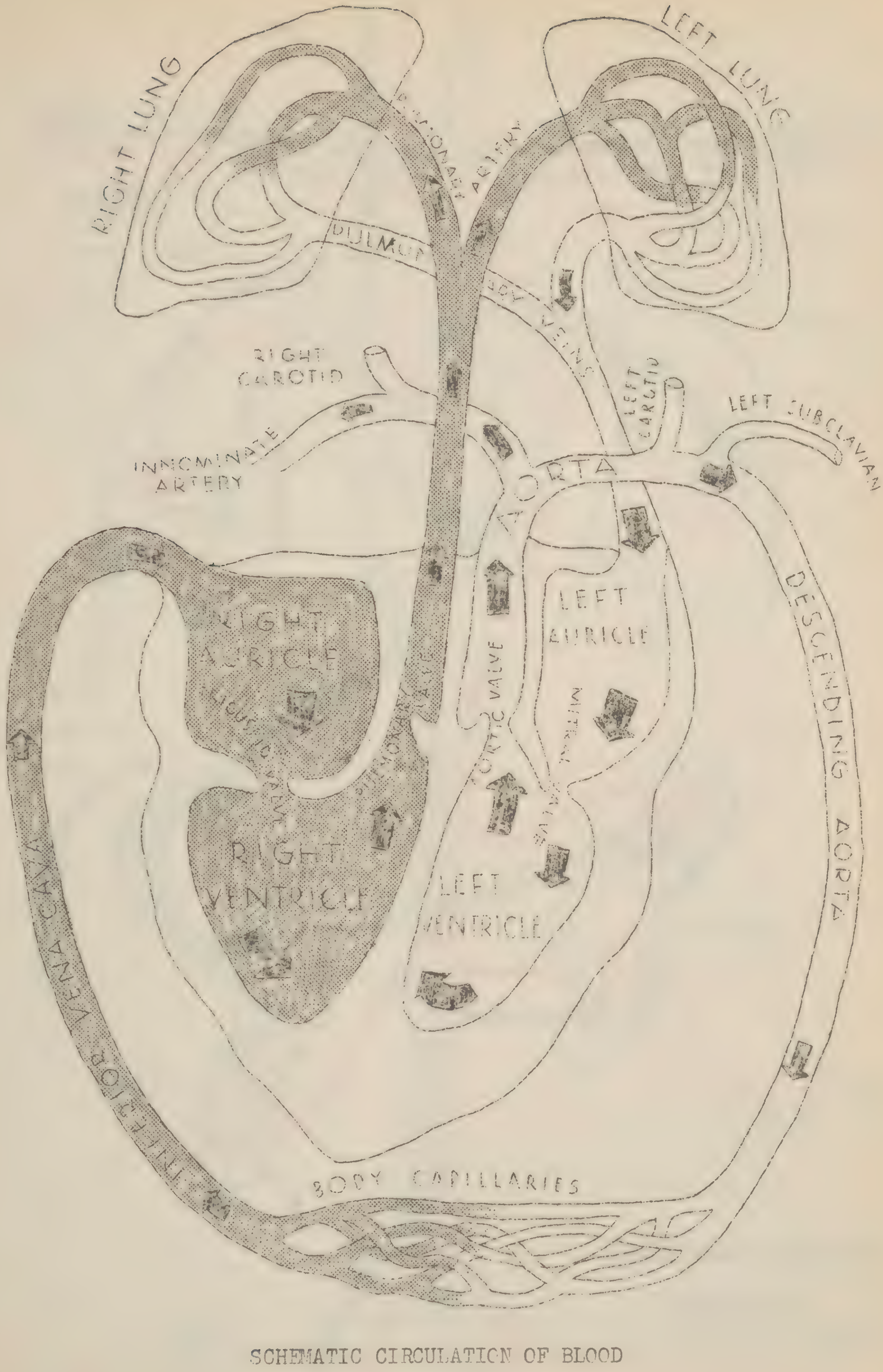
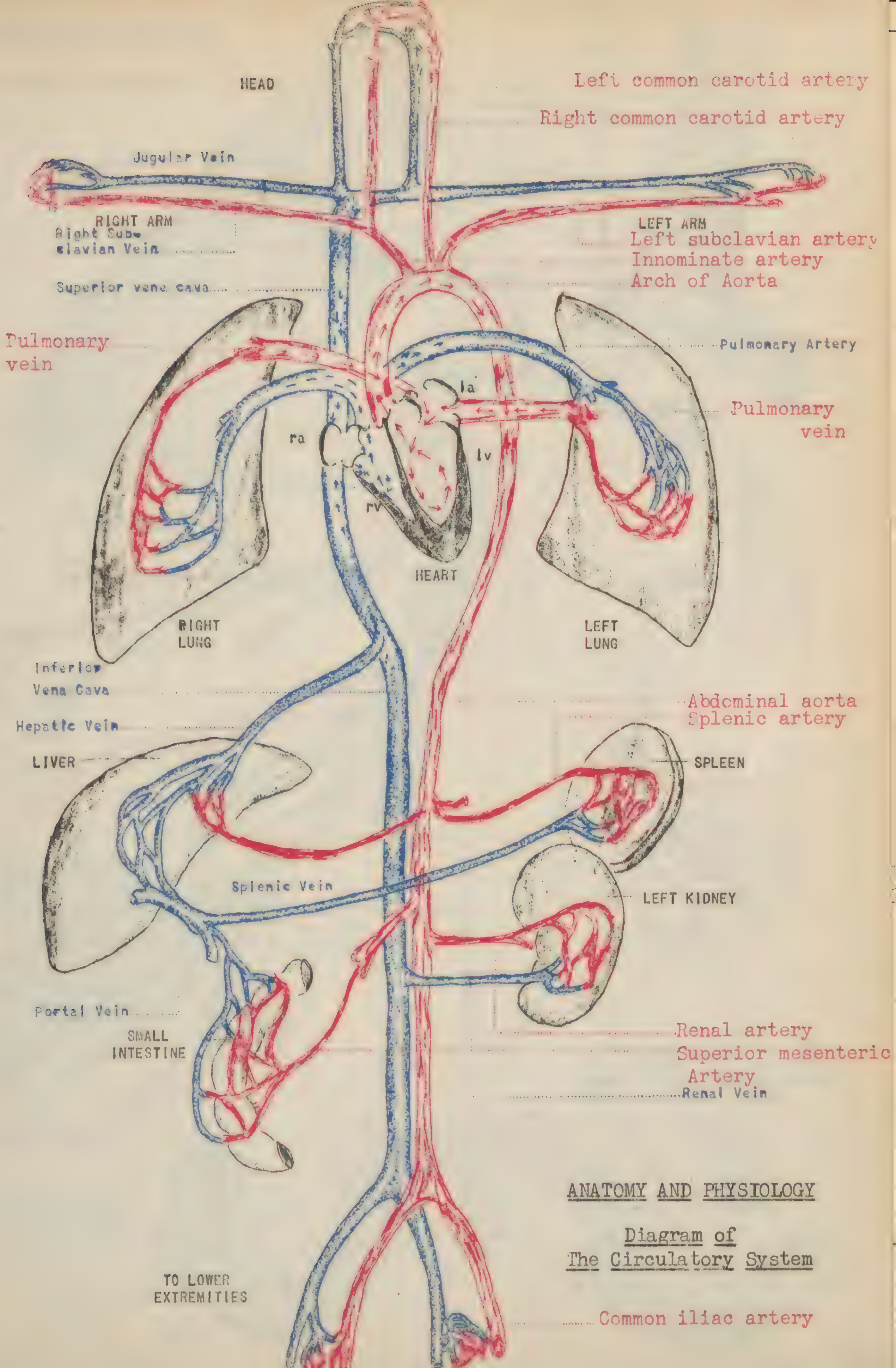


SCHEMATIC CIRCULATION OF BLOOD

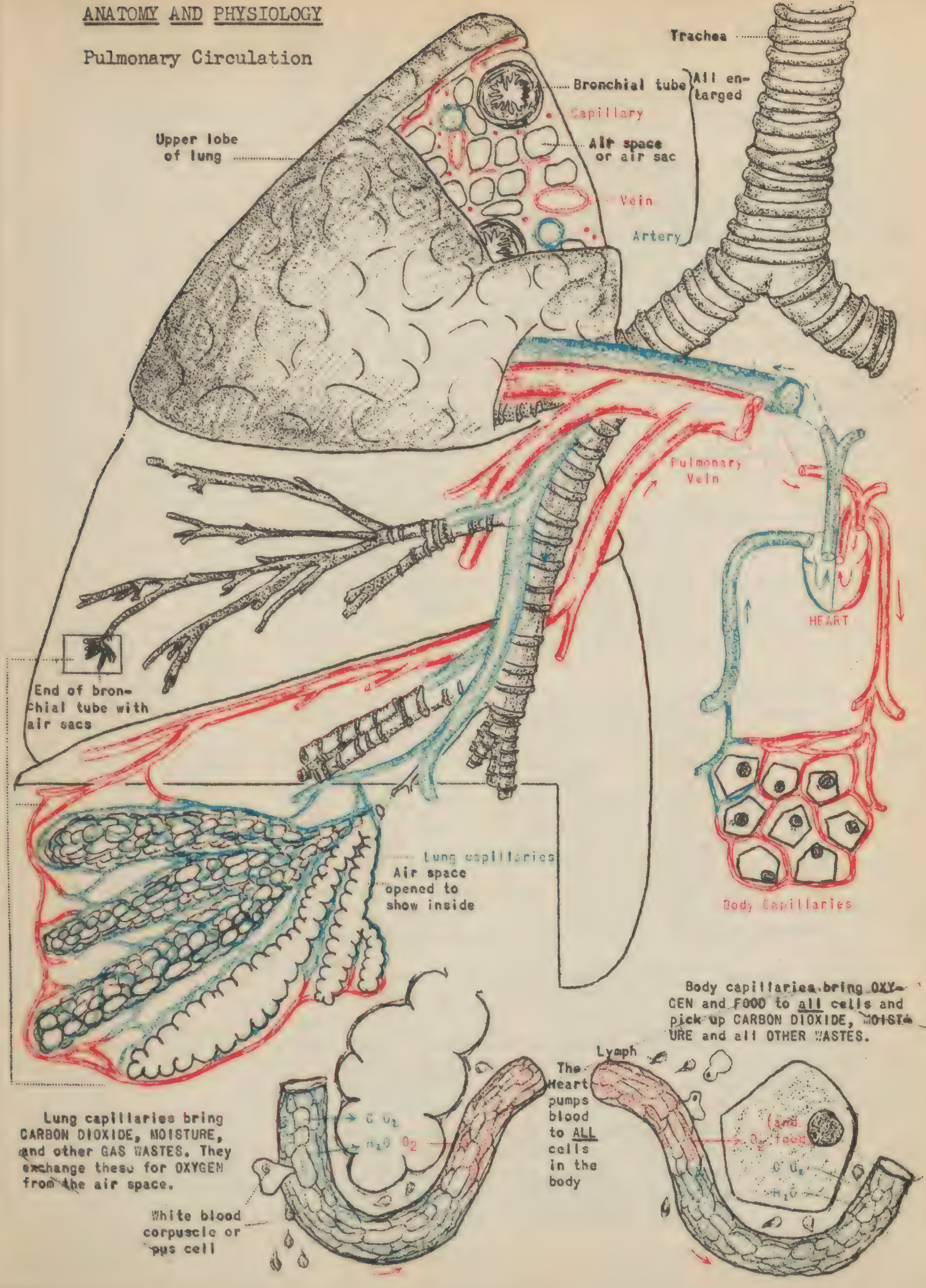


ANATOMY AND PHYSIOLOGY

Diagram of
The Circulatory System

ANATOMY AND PHYSIOLOGY

Pulmonary Circulation



a. Functions of the nose.
   (1) Warms and moistens the air.
   (2) Hairs strain the air.
   (3) Location of sense organs of smell.
   (4) Paranasal Sinuses and Nasolacrimal duct communicate with nasal cavity.

b. Pharynx - a vertical tubular passage which extends from the base of the cranium posterior to the nasal cavity to the beginning of the esophagus at the lower end of the cricoid cartilage. Anteriorly, it communicates with nasal cavity, beneath this the oral cavity and below the laryngeal cavity. The opening of the Eustachian tubes are present on the lateral walls of naso-pharynx, the posterior wall of naso-pharynx contains adenoids. In the lateral wall of the oral pharynx, on either side, the tonsils are located.

c. Larynx - composed of cartilages, thyroid cartilage (Adam's Apple) and cricoid cartilage, held together by ligaments and muscle. Larynx contains the vocal cords and lies between the base of the tongue and trachea, opening to Larynx; is protected by epiglottis. The thyroid gland lies below the thyroid cartilage or Adam's Apple.

d. Trachea or windpipe - composed of cartilage - cartilage ring, C-shaped, not complete posteriorly - cartilage serves to prevent collapse of trachea.

e. Bronchi - cartilage rings - as trachea and larynx. Right and left bronchi divide and continue to divide like tree branches, and finally terminate into terminal bronchus and air cells or sacs like bunch of grapes - this is lungs proper.

f. Lungs - essential organs of respiration, with heart between - fill chest cavity. Right and left lungs - right 3 lobes, left 2 lobes, covered by pleura. Visceral pleura is adherent to lungs, parietal pleura lines the walls of the pleural cavity.

g. Mediastinum - region between mediastinal portions of the two pleural sacs. Is bounded anteriorly by sternum, posteriorly by vertebral column, laterally by lungs. Within the mediastinum are placed the heart, aortic arch, arteries and veins, part of the superior vena cava, trachea, esophagus, thoracic duct, nerves (phrenic and vagus), thymus gland, lymph nodes, areolar tissue.

2. Function.

a. Respiration - alternating expansion and contraction of chest - drawing air in and forcing it out - inspiration and expiration. Rate - 18 in adults.
   (1) Mechanics of respiration - diaphragm, contracts, capacity of chest increases, air rushes in - this is inspiration; diaphragm relaxes, chest wall collapses, air forced out - this is expiration. If respiration increased, intercostal muscles and other muscles play part as abdominal and chest muscles. Air - outdoor - 21 parts oxygen, nitrogen 79 parts; oxygen-necessary for life. Respiration - oxygen taken in lungs, carbon dioxide given off.

G. Digestive System - consists of alimentary canal, salivary glands, liver and pancreas.

1. Alimentary canal; mouth, pharynx, esophagus, stomach, small intestines, large intestine, muscular tube, 30 foot long from lips to anus.

   a. Mouth - mastication of food and mixed with saliva, slight digestion conversion of starch to sugar. Saliva comes from 3 salivary glands; parotid submaxillary and sublingual. Structures within mouth - teeth, tongue, in back of mouth, fleshy curtain, palate; from center of palate, uvula, on either side and behind palate are tonsils. After food is masticated it is pushed by the tongue into the pharynx; thence through 9 inch muscular tube - esophagus or gullet, into stomach.

   b. Stomach - muscular bag lined with mucous membrane, thrown up in numerous folds called rugae, which gives more surface. Gastric glands lie in the mucosa. Two types - one produces hydrochloric acid, the other pepsin or protease. Pear shaped, large end to the left, and lying in the upper part of abdomen, behind ribs, separated from thoracic cavity by the diaphragm. Two openings, one connected with esophagus called cardiac end, and other connected with small intestines called pyloric orifice.

   c. Small Intestines - 25 feet long. Narrowest part of the digestive tract, occupying the central and lower parts of the abdominal and pelvic cavity, suspended from the spine by a fold of peritoneum called mesentery, terminates in valvular opening into large intestines, divided into duodenum, jejunum, ileum.

   d. Large Intestines - 5 feet long. Commences in right groin (cecum) - appendix extends downward from cecum. Cecum as it passes up right side of abdomen is ascending colon, under liver, turns and crosses to left in front of stomach, transverse colon, in left upper abdomen it turns downward, descending colon, in left groin curves like letter S sigmoid flexure, which ends in rectum, descending to right and backward to anus. Covering of intestines and lining abdominal cavity - smooth shining membrane - peritoneum. Omentum - fatty apron made up of peritoneum and contains fat, lies over and covers intestines. Mesentery - peritoneal folds binding intestines loosely to abdominal wall behind. Weak areas in abdominal wall due to blood vessels passing out of abdominal cavity. Weak places are umbilicus or navel, inguinal canal where vessels pass to testicles, femoral canal for vessels in the thigh. Hernia may result - umbilical, inguinal and femoral.

   e. Liver - largest gland in body, weight 4 to 4-1/2 lbs. - lies behind ribs - divided into 2 lobes. Gallbladder and its duct, situated on under surface of liver, duct empties into small intestine.

   f. Biliary System - The biliary system consists of the bile ducts both inside the liver and outside of it, and the <u>gall bladder</u>. The right and left <u>hepatic ducts</u>, one from each lobe of the liver join to form the <u>common hepatic</u> duct. The gall bladder, you might say, is a large outpouching of the common hepatic duct. The gall bladder is connected to the common hepatic duct by a narrow duct

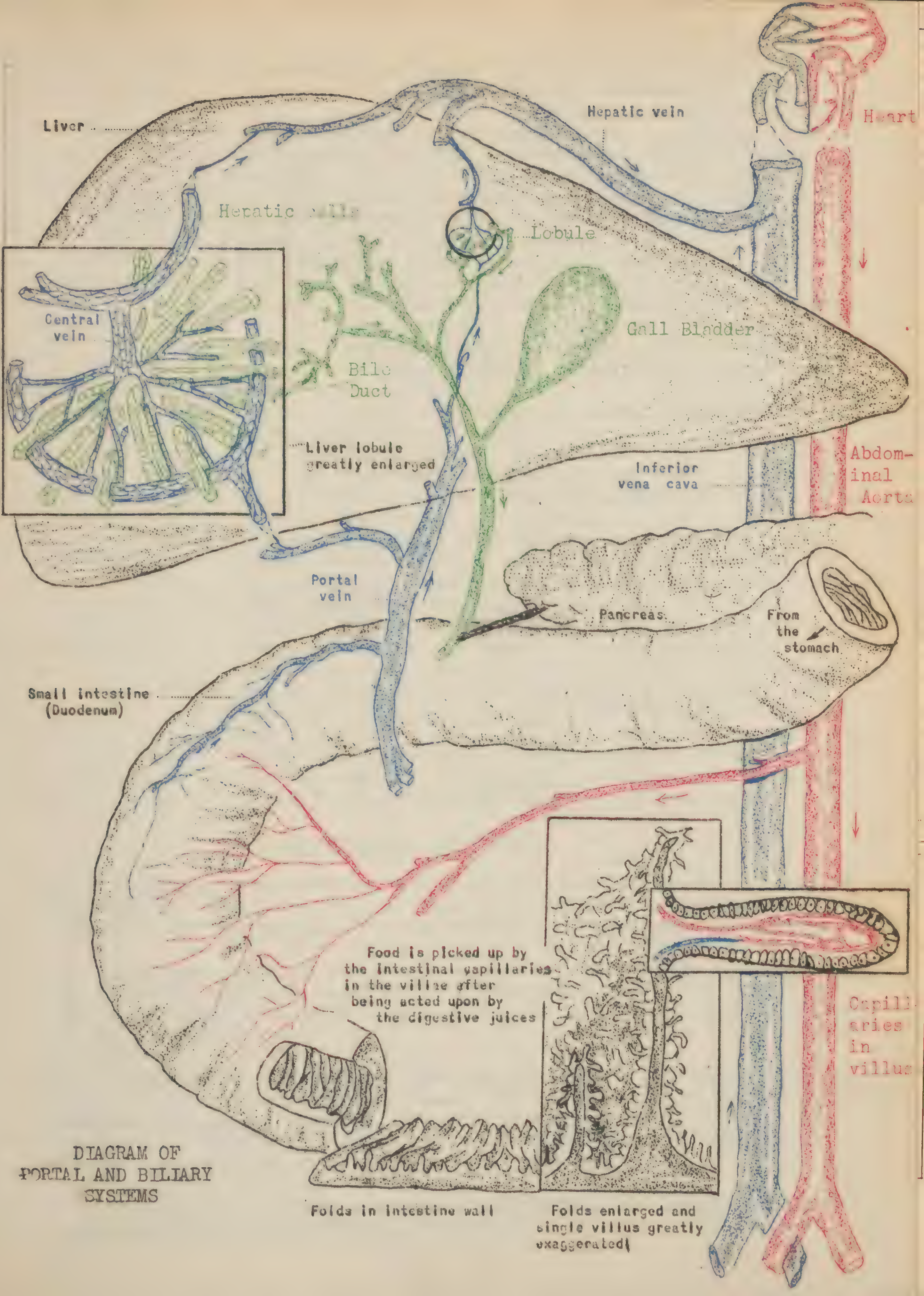


DIAGRAM OF PORTAL AND BILIARY SYSTEMS

called the cystic duct. From the junction of the cystic duct the common hepatic duct down, it is known as the common bile duct. The common bile duct and the pancreatic duct join to enter the duodenum together about 4 inches from the pyloric sphincter of the stomach. The gall bladder is a thin muscular bag lined with mucous membrane, where the bile, which is formed in the liver, is concentrated and stored until needed for digestion. In addition a thin mucous is added to the bile by the mucous glands of the gall bladder.

(1) Functions of the Liver and Biliary System.
    (a) Storage of sugar (glycogen).
    (b) Production of urea, secretion of bile. Bile - helps emulsify and digest fats, stimulates the intestinal muscles to contraction, acts as laxative, prevents putrefaction of intestinal contents.

f. Spleen - to left of stomach and behind ribs - dark in color, size of small hand.
   (1) Function - none for digestion.
       (a) Reservoir for blood storage during digestion.
       (b) Production of leukocytes, destroys R.B.C.
       (c) Production of uric acid.

g. Pancreas - placed deeply behind stomach, extends transversely across abdomen, slender tongue-shaped gland - 6 in. by 3/4 in. - cream color; duct which terminates into small intestines with common duct. The head of the pancreas lies in the first bend of the duodenum and the tail lies against the spleen. The pancreas has two separate types of glandular tissue. One type secretes digestive juices into the pancreatic duct and the other type, the islets of Langerhans, secrete insulin directly into the blood stream. Insulin is the substance which has to do with carbohydrate metabolism and it is the lack of it that causes Diabetes Mellitus. Thus, the pancreas is a gland of both internal and external secretion.

PHYSIOLOGY OF DIGESTION

Digestion is the process of getting foods into soluble form, so as to fit them for absorption into the blood, by means of which they may be carried to all the tissues. This alteration is brought about by enzymes.

An enzyme is an organic catalyst, produced by a living organism. An enzyme increases the speed of a reaction without adding in any way to the energy changes involved in the reaction or taking part in the formation of the end products.

Enzyme action is specific. That is, a certain enzyme will act on one type of food stuff alone and no other. Enzymes also have an optimum temperature and optimum reaction. The optimum temperature of course is body temperature. The optimum reaction is acid for the gastric enzymes and alkaline for the intestinal and pancreatic enzymes.

The types of food may be classed as inorganic and organic. The inorganic foods are water and salts, which need no digestion. The organic

foods are: carbohydrates (sugars and starches), fats, and proteins. In addition there are accessory foods (also organic) which are known as vitamins.

Digestion begins in the mouth by the process of chewing the food and mixing it with salivary enzyme amylase which begins the digestion of starch. After the voluntary act of swallowing, which has already been discussed, the bolus of food is passed down the esophagus by the involuntary muscles to the stomach by peristaltic waves. In the stomach gastric enzymes, protease or pepsin and rennin with the aid of hydrochloric acid, begin the break down of proteins and fats respectively; this is done as the food is churned about and mixed with the gastric juice.

The presence of food in the stomach sets up reflexes which cause bile to be released from the gall bladder and pancreatic juice from the pancreas into the duodenum. When the food in the stomach is well mixed with gastric juice, the pyloric valve opens and the food passes into the duodenum.

In the duodenum and small intestine the food is mixed with the bile, intestinal and pancreatic juice and digestion is completed. The bile emulsifies the fats so that they can be broken down into fatty acids and glycerol by pancreatic lipase. The proteins are further broken down into amino acids by pancreatic and intestinal proteases. The digestion of starches and complex sugars into glucose is completed by various enzymes from both the pancreas and small intestine.

Now the fatty acids, amino acids and glucose are ready for absorption. This takes place through the small capillaries which lie in the villi of the small intestine. The majority of the fatty acids are taken up by small lymphatics, called lacteals, also situated in the villi and as chyle is emptied into blood stream through the thoracic duct.

The digested, as well as the undigested food and water, is passed along the small intestine by peristaltic waves. By the time the contents of the small intestine reach the ileo-caecal valve, digestion and absorption of the food products is complete.

In the large intestine the undigested and unabsorbable food is also passed along by peristalsis, but at a much slower rate; taking from 24 to 36 hours to pass through. In the large intestine the excess water is absorbed and more or less dry formed stools are produced. Anything which increases the rate of passage through the colon will give a watery stool or diarrhea.

There are numerous bacteria which normally live in the intestinal tract chiefly in the colon. These are chiefly the Bacillus Coli group and a few gas forming bacilli. As long as these bacteria remain within the intestinal tract, they do no harm, but once free in the peritoneal cavity, as from a ruptured appendix or gun shot wound of the abdomen, they set up a very serious inflammation called peritonitis, which causes death more often than not.

Defecation. The dried feces having accumulated in the rectum, sets up a defecation reflex. The internal sphincter is automatically released. At the convenience of the individual, the external, voluntary, sphincter is

ANATOMY AND PHYSIOLOGY

PROCESS	MOUTH	STOMACH	SMALL INTESTINE (Duodenum, jejunum, ileum)	LARGE INTESTINE
MECHANICAL DIGESTION	Teeth	Peristalsis	Peristalsis	Peristalsis
		(Liver - bile) (Pancreas-Trypsin, Amylopsin, Steapsin)		
CHEMICAL DIGESTION				
Carbohydrates	Saliva begins digestion of carbohydrates here.	None added	Pancreatic and intestinal juices complete digestion here.	None
Proteins	None	Pepsin, rennin and hydrochloric acid begin digestion of proteins here.	Pancreatic and intestinal juices complete digestion here.	None
Fats	None	None	Bile begins digestion of fats here Pancreatic and intestinal juices complete digestion here.	None
ABSORPTIONS	None	Water, alcohol, (glucose if eaten) and some drugs here.	Glucose, blood protein (albumin) and blood fat absorbed here as rapidly as they become digested. Also vitamins, minerals and water.	Excess water removed here.

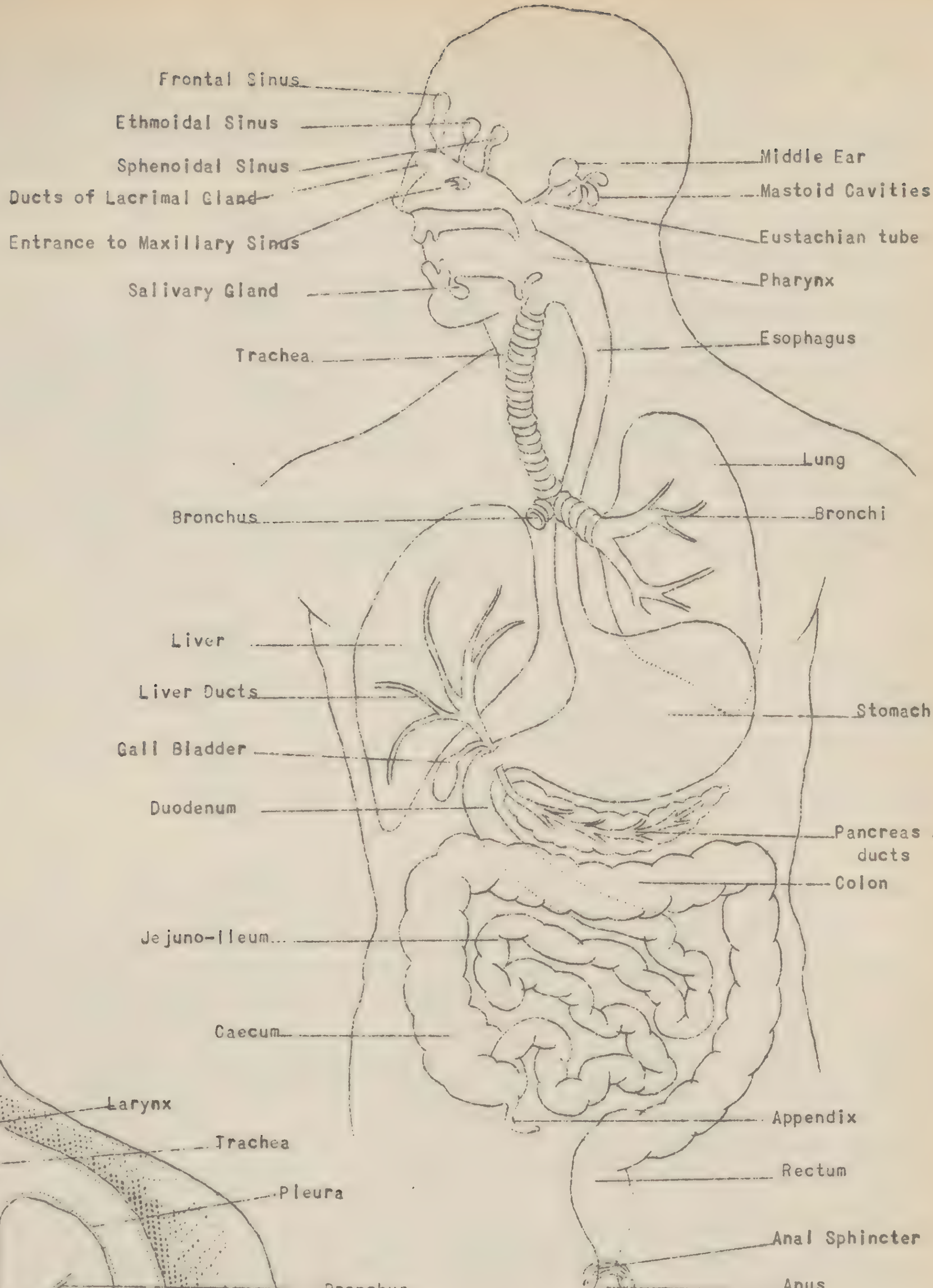


DIAGRAM OF THE GASTRO-PULMONARY MUCOUS MEMBRANE, SHOWING THE CONTINUITY OF ALL ITS PARTS

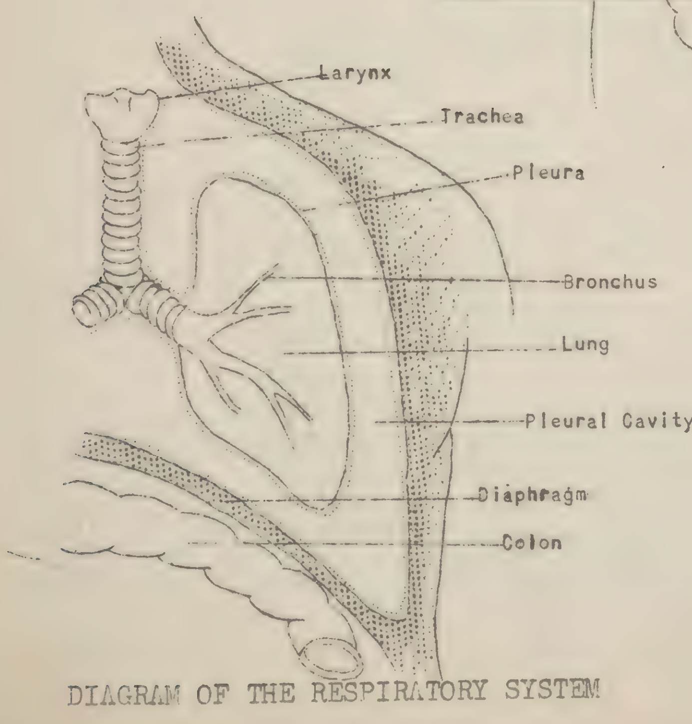


DIAGRAM OF THE RESPIRATORY SYSTEM

released, the internal abdominal pressure is increased by tightening the voluntary abdominal muscles and the contraction of the diaphragm. At the same time, the levator ani, a voluntary muscle, which is attached to the anal or voluntary sphincter, is contracted, thus lifting the lower end of the rectum up over the formed stool so that it is expelled.

(1) Summary of Functions of the Pancreas.
  (a) Pancreatic juice which digests all foods, proteins, fats and sugars.
(2) Produces insulin necessary for carbohydrate metabolism.

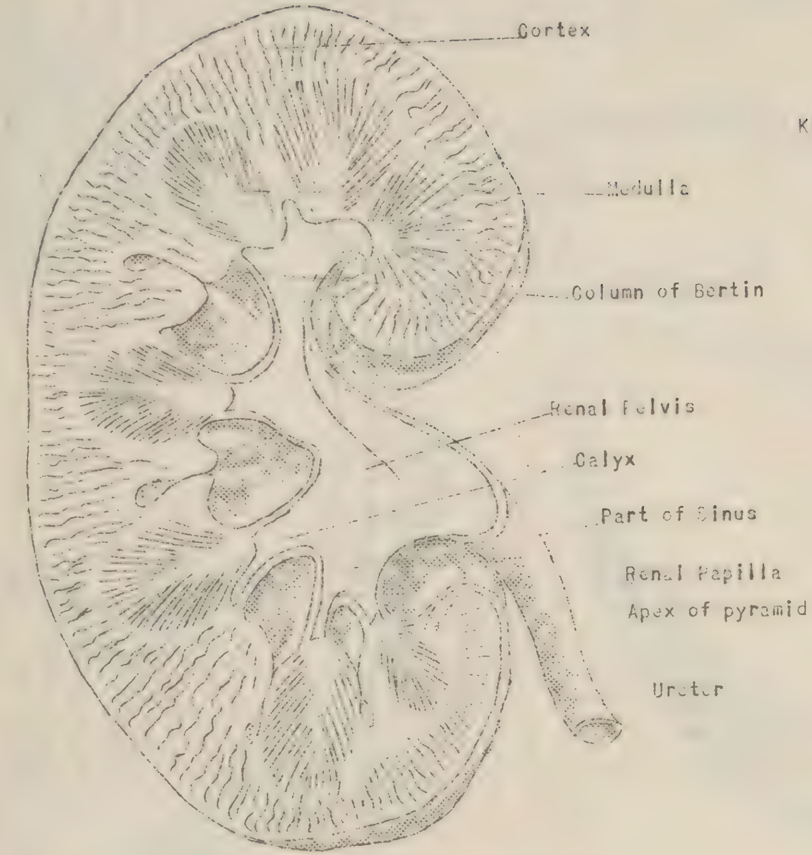
H. Urinary Apparatus - consists of kidneys, which secrete urine and the ureters which convey it to the bladder, accumulates and discharges through urethra.

1. Kidney - one on each side of lumbar vertebrae in back of the abdominal cavity behind the peritoneum. They are 4 in. long by 2 1/2 in. wide and 1 1/2 in. thick, weight about 5 oz., are bean shaped, with concave side turned toward spine, convex side outward. Hilum- depression near center of concave side serves for vessels to enter and leave.
   a. Structure
      (1) Cortex - outer part - secreting part.
      (2) Medulla - aggregation of urinary tubules on their way to pelvis of kidney; by arrangement of blood vessels, the arterial blood is brought directly to the glomerulus. It is during its circulation through the glomerulus that the blood filters some of its water and dissolved substances. Then tubules reabsorb some of its dissolved substances.

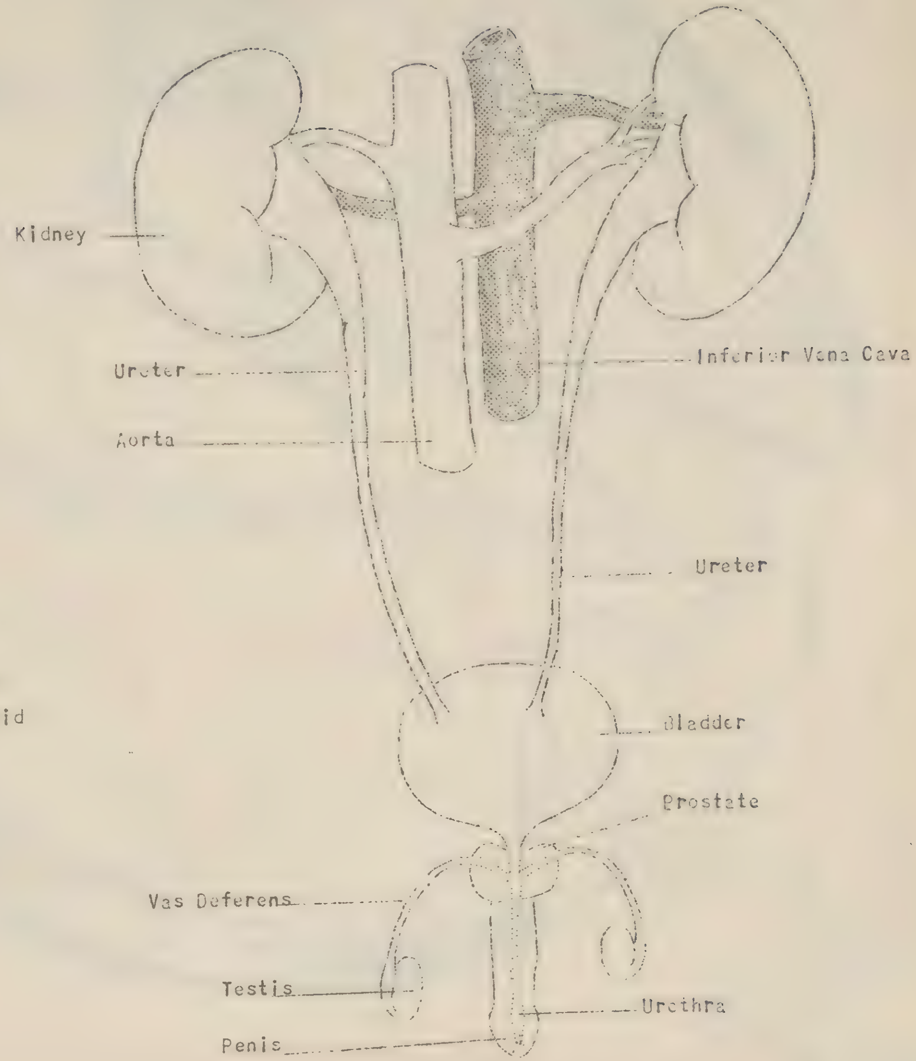
      (3) Pelvis - on the inner side of each kidney is a deep depression containing a funnel-shaped sac - the pelvis which receives termination of urinary tubules.
2. Ureters - 2 muscular membranous tubes, 16 in. long, extending from kidney pelvis to urinary bladder.
3. Bladder - muscular bag, serves as reservoir for urine, situated in the pelvic cavity behind the pubes, held in position by ligaments; moderately filled, contains about 1 pt., has rounded form. When full, it rises into abdomen and can be felt. The neck of the bladder is embraced by the prostate gland, which in old men becomes enlarged and obstructs flow of urine to the outside.
4. Urethra - 3 to 9 in. long, extends from the neck of bladder to the meatus, urethra under pubes describes a curve with concavity upperward.
5. Urine - water solution of uric acid, coloring matter, and salts mostly, urates, phosphates, carbonates, and chlorides. Man passes about 3 pts. a day. This contains 1 1/2 oz. of solids. Yellowish color, acid and S.G. 1015 to 1025. Urea - most important - more than 1 oz., being excreted daily. Urine, when passed is clear, may become cloudy and sediment form - on heating, if cloudiness disappears, it is due to urates, if acid added and disappears, due to phosphates. Abnormal constituents of urine in disease are albumin, sugar, bile, blood and pus.

6. Suprarenal Glands - two small flattened bodies, yellowish in color, one immediately above each kidney. Nothing to do with excretion of urine. Function is to sustain muscular tone especially blood vessels. Adrenalin is produced by this gland; the lack of this gland causes death and disease of it is known as Addison's Disease.

I. The Male Organs of Reproduction
   1. Penis
      a. The penis is the organ of copulation and contains three cylinder-like structures of erectile tissue, containing multiple spaces or lacunae which become engorged with blood, via the internal pudic arteries, and produce the condition known as erection. Two of these cylindrical structures are known as the corpora cavernosa and one, through which the urethra passes, is called the corpus spongiosum.
         (1) The urethra serves the double purpose of urination and the ejaculation of semen during the sexual act. The enlargement at the distal end of the penis is called the glans penis.
   2. Prostate Gland.
      a. The prostate gland is about the size of a horse chestnut and surrounds the neck of the bladder. It contains numerous tubules and secretory epithelia, and elaborates a secretion which mixes with that of the seminal vesicles, and spermatozoa from the testes, to form the semen.
      b. Functions
         (1) Lubrication.
         (2) Propulsion of spermatozoa.
         (3) Nutritional media for spermatozoa
         (4) Neutralization factor for vaginal secretions.
      c. In some men this gland becomes large and hypertrophied so that it interferes with urination. In these cases surgical measures may be necessary to give relief; either by removal, resection of part of the enlargement through the penis with a special instrument called a resectoscope, or by means of an open operation when the enlarged gland is (enucleated) removed.
   3. Seminal Vesicles: the seminal vesicles are two small multiple sac-like structures located on the lower back portion of the bladder, posterior to the prostate, and function as reservoirs for the spermatazoa. They also elaborate a secretion which helps make up the semen.
   4. Vas Deferens: the vas deferens are two muscular tubules that conduct semen from the testes to the Seminal Vesicles and Prostate. They join with the seminal ducts to form the ejaculatory ducts.
   5. Testes.
      a. The testes, or testicles, are the glands of reproduction and are located in the sac known as the scrotum. They are encapsulated with a fibrous sheath, known as the tunica albuginea, which partitions the testes into about 140 segments, each containing from 1 to 3 tortuous tubules of highly specialized epithelium, known as the germinating epithelia - this consists of two types.
         (1) The germinating or spermatogenic, which produces the spermatozoa.



LONGITUDINAL SECTION OF HUMAN KIDNEY



THE URINARY SYSTEM VIEWED FROM BEHIND

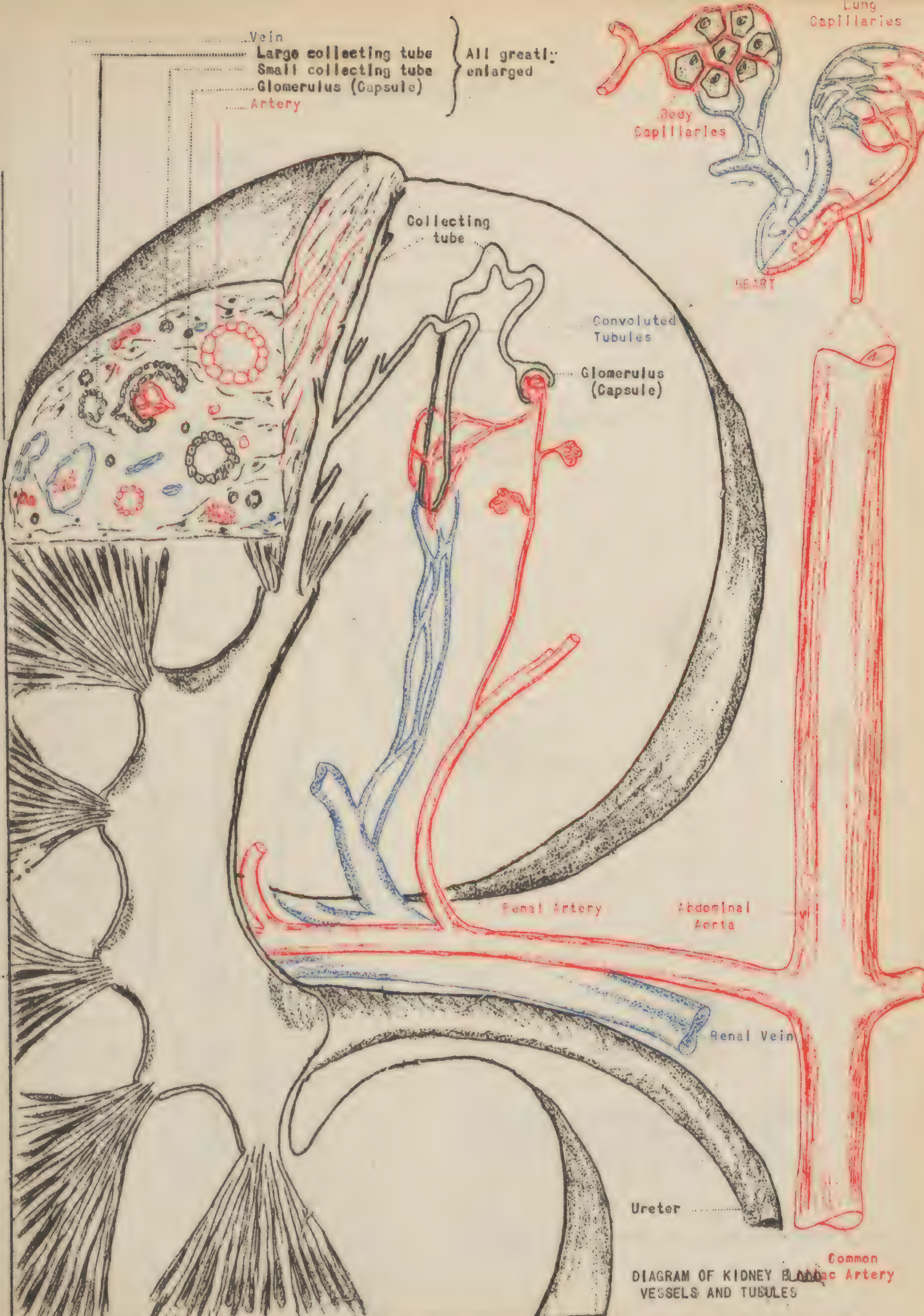
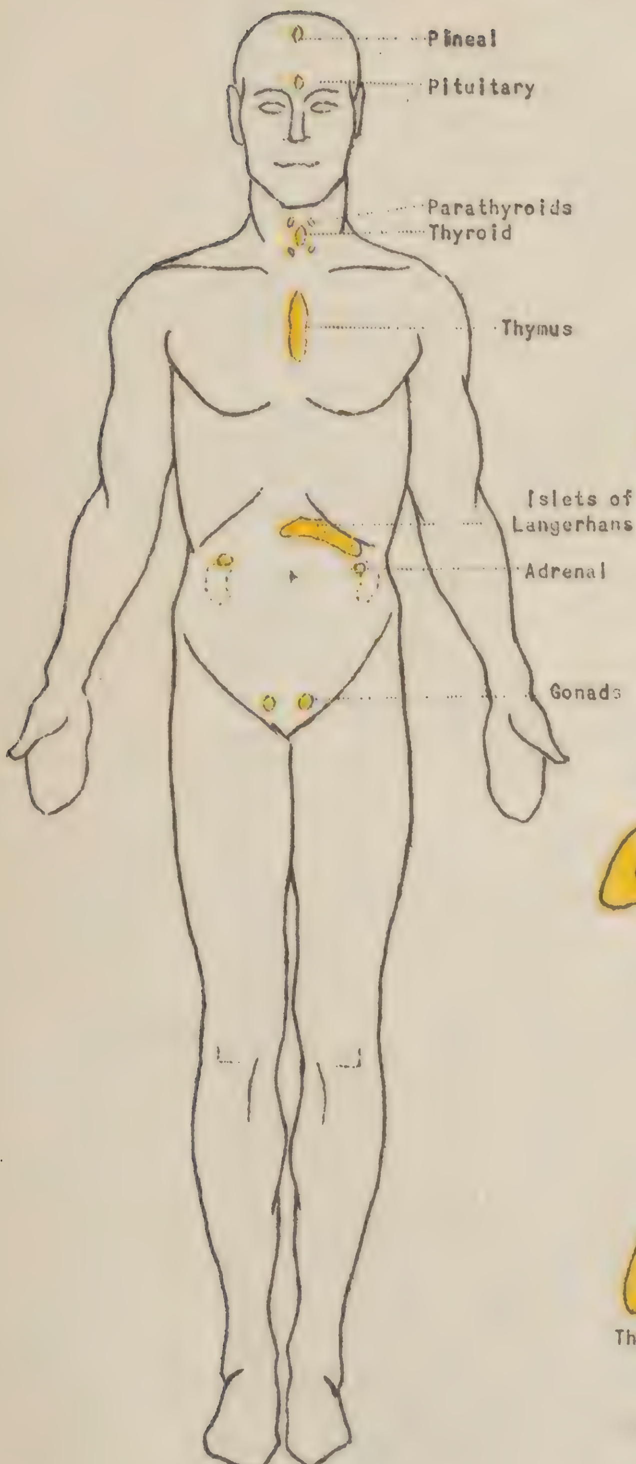


DIAGRAM OF KIDNEY BLOOD VESSELS AND TUBULES



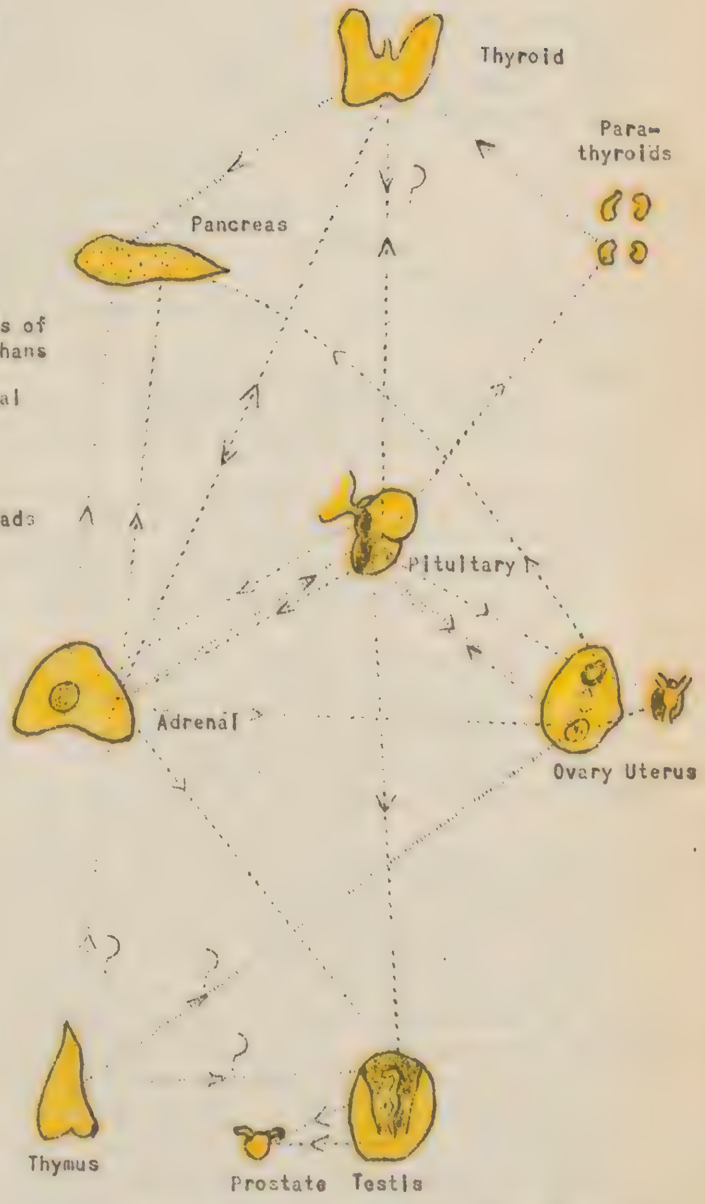


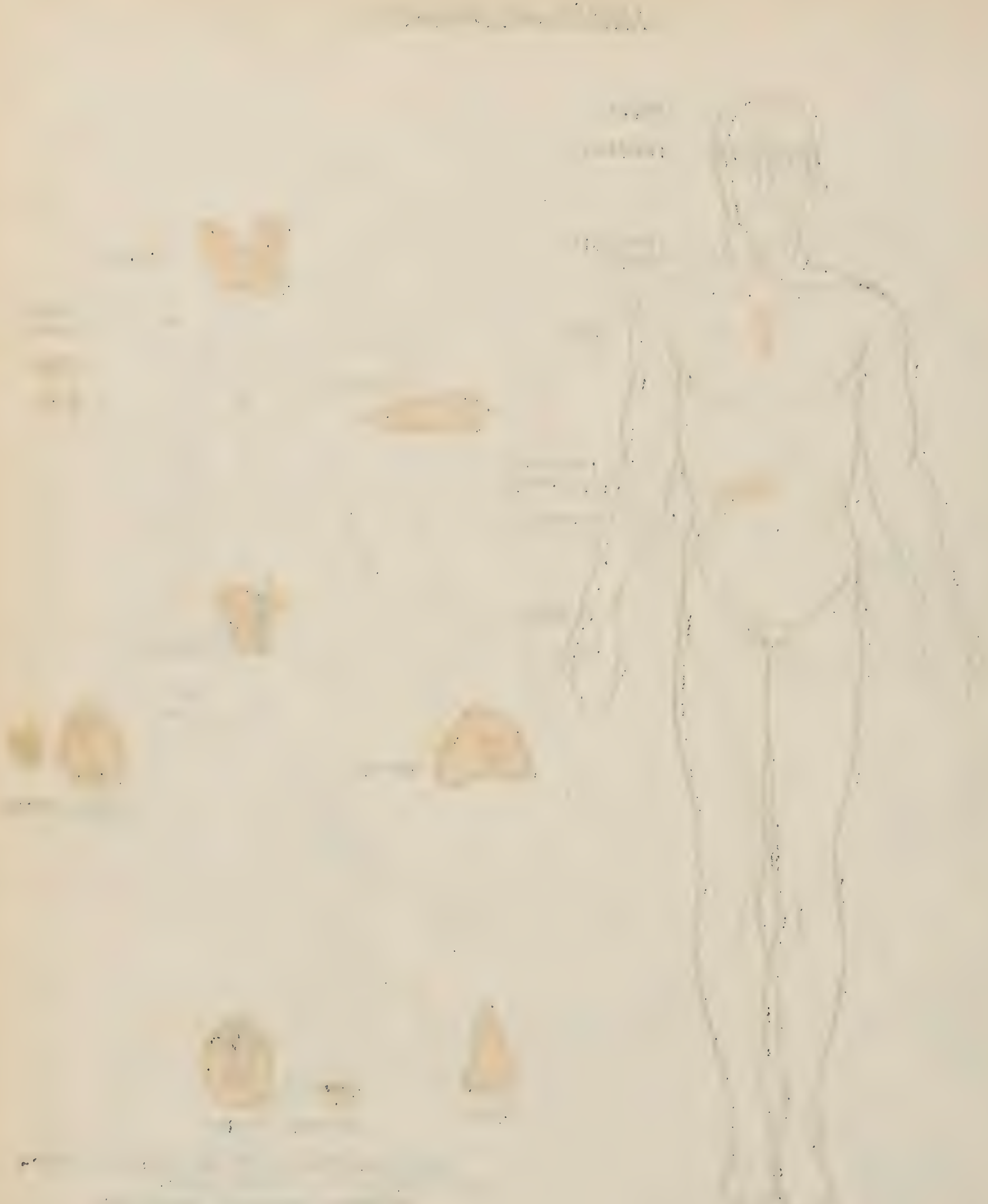
DIAGRAM ILLUSTRATING THE MORE IMPORTANT INTER-RELATIONSHIPS OF THE ENDOCRINE GLANDS.

.... Indicates synergism or stimulation

.-.-.-.-.- Indicates antagonism or inhibition

Arrows point in the direction of such reactions

Question marks indicate possibilities without adequate evidence



(2) The supportive cells (Sertoli) from which the tails of the spermats are derived.

b. The testis also has an internal secretion that is necessary for the development of the secondary characteristics of the male, such as form, structure, voice, beard, etc.

6. Epididymis: on the back of the testicle and part of its structure; it is a convoluted tubular mass, connecting the tubules of the testis with that of the Vas Deferens, and is known as the epididymis. It is in this structure that the spermatozoon matures in route to the seminal vesicles for storage, or exit via ejaculation.

7. The spermatozoon or spermat, is the male fertilization seed. It develops in the spermatogenic epithelia of the testes, and as a rule, is very prolific. The average discharge will contain from ten thousand to a million or more. It averages .05 M.M. long and consists of three parts:
   a. Head which contains the chromatin.
   b. Middle piece, contains the centrosome.
   c. Tail, only use is flagellation or locomotion.

J. The Female Organs of Reproduction.

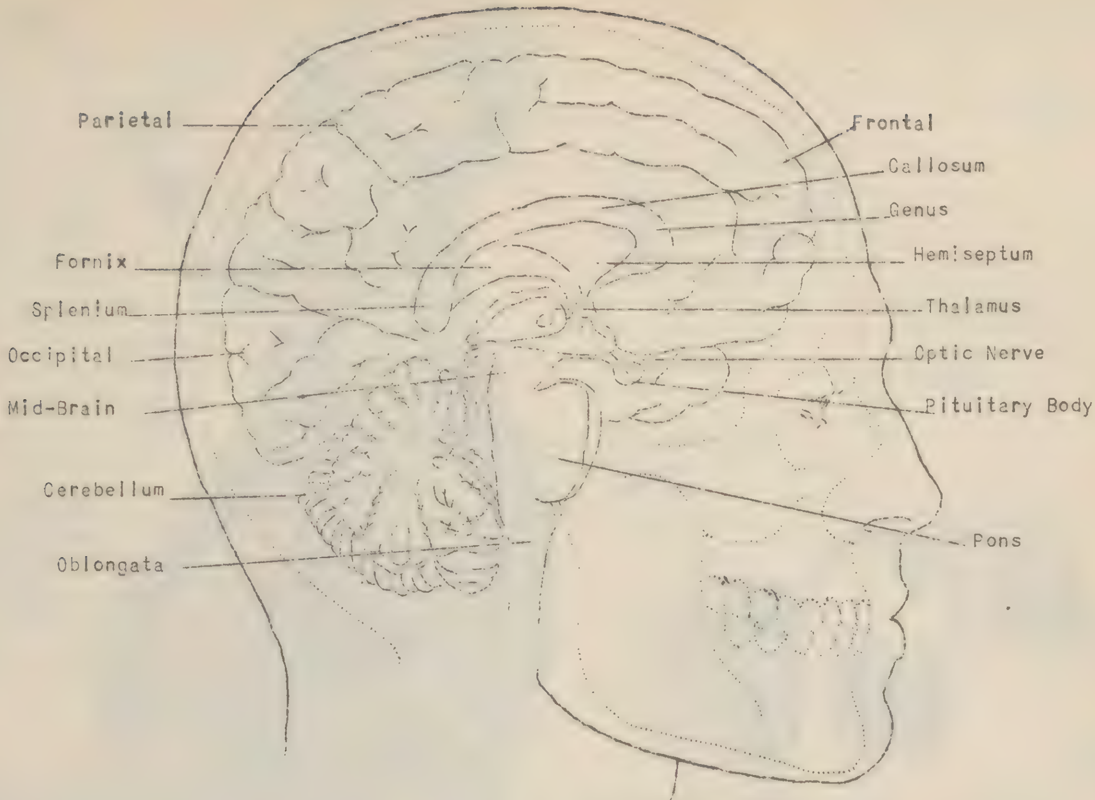
1. Labia Majora and Minora - large and small lips. They are protective and sensory.
2. Clitoris: a homologue of the penis, but in comparison is more richly supplied with nerves - function: chiefly sensory.
3. Vagina: the depository vault where from the semen travels up into the womb.
4. The womb or uterus: the birth chamber wherein the fertilized ovum usually becomes entrenched and normally develops for nine months, obtaining nourishment and blood for growth from the mother through special vessels that develop in the walls of the uterus.
5. Fallopian tubes or oviducts: are two tubes, homologous (similar in function to Vas Deferens in the male) that conduct the ovum, or female egg, from the ovary where it is developed and extruded, to the uterus. Fertilization of the ovum, by the spermat, takes place, as a rule, in these tubes, and takes about 9 days to complete the descent to the uterus.
6. Ovary: the ovaries are homologous to the testes, and like the testes have a dual function. They elaborate an internal secretion which is largely responsible for the female secondary characteristics, such as form, voice, skin, hair, etc. They also produce, via the Graafian follicles, the female eggs or ova. About once every 28 days in the average woman one of these eggs matures and is extruded from the ovary. If not fertilized by the male seed, they become part of the process known as menstruation. If fertilized by the male seed, it becomes the mother or chief unit of reproduction. The head and middle piece of the male seed enters the ovum via the germinal spot, whereas the tail, having served its purpose, is cast away at time of entry. The ovum is quite large compared to the spermat, it being 1/125 inch (0.2 mm) in diameter. It is estimated that about 35,000 ova are present in both ovaries of the average normal woman.

K. The Endocrine System - or the glands of internal secretion are the islet cells of the pancreas, thyroid gland, parathyroid glands, suprarenal or adrenal glands, the hypophysis cerebri or pituitary, and certain tissues of the gonads or testes and ovaries. These glands secrete certain chemical substances, called hormones, directly into the blood

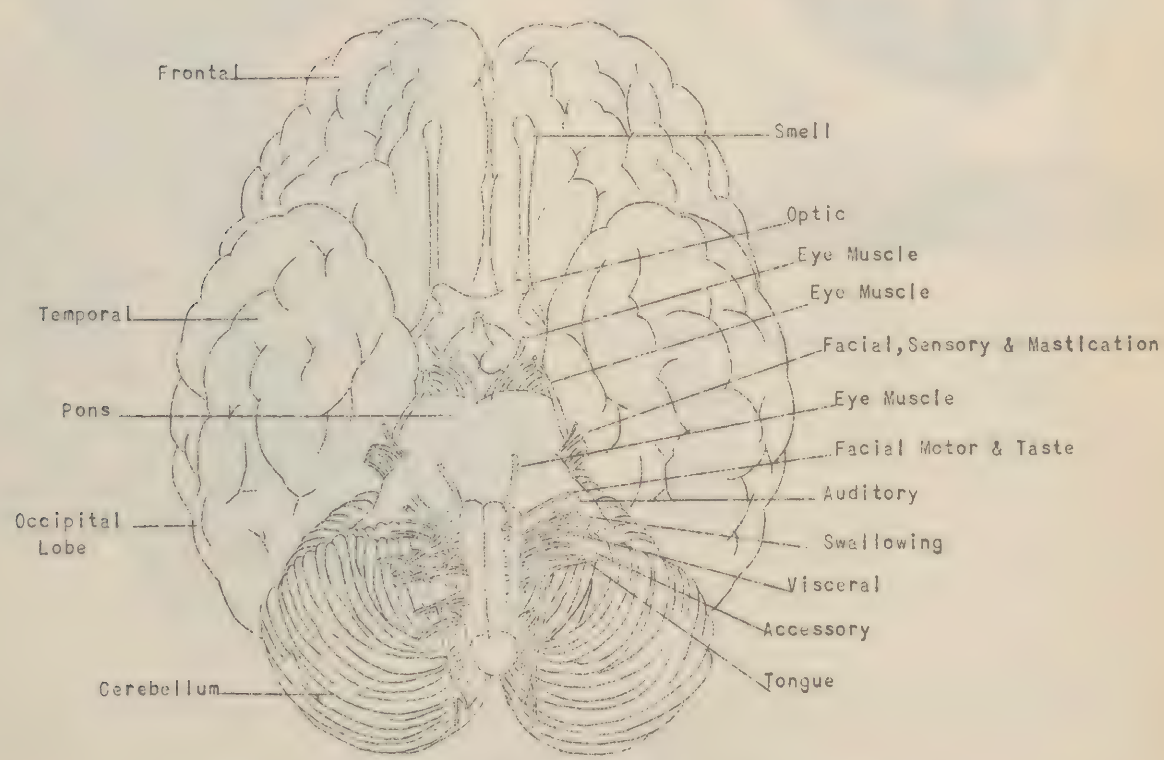
which have to do with the growth and development of the body and its control in relation to its environment.

I. Nervous System and Special Senses - consists of brain, spinal cord and nerves. This constitutes the cerebro-spinal system; ganglia and connecting nerves - autonomic system.

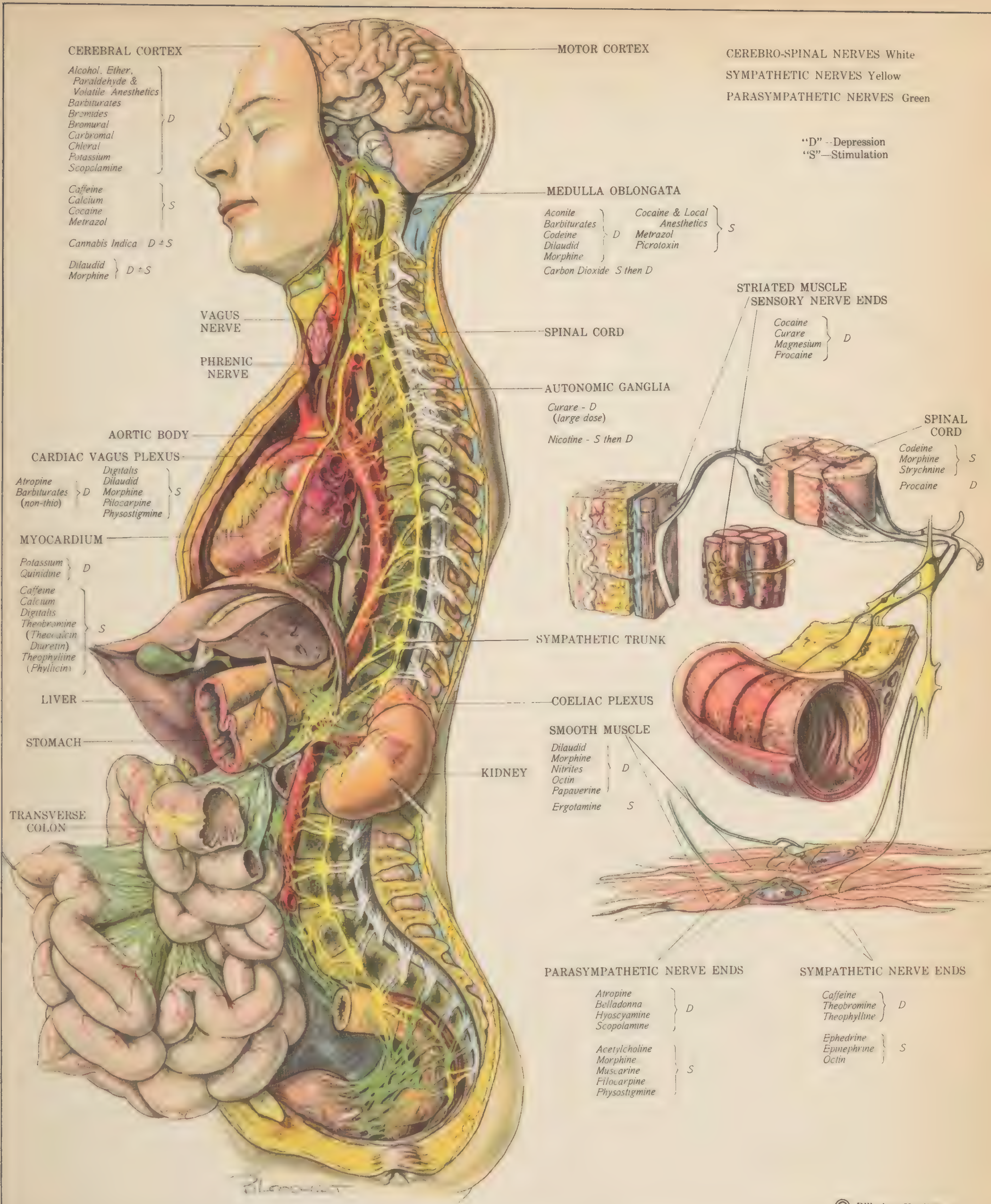
1. Brain - situated in the cranium or skull - is "seat" of intellect and will.
   a. Parts: - cerebrum, cerebellum, pons and medulla.
      (1) Cerebrum - soft, pulpy, oval mass, divided into two hemispheres by a fissure; the hemispheres are connected by a dense layer of transverse fibers, called corpus callosum. Brain surface has numerous grooves or sulci, between which are the convolutions. Cortex or exterior - gray matter, medulla or interior white matter. White matter is a collection of nerves connecting various parts of brain and spinal cord. Gray matter is seat of mind, contains different centers (visual, auditory, etc.) Within brain are cavities - ventricles contain fluid. Brain - delicate and easily injured (fractures of skull, apoplexy).
      (2) Cerebellum - little brain - mass of nervous tissue, maintains equilibrium of body.
      (3) Pons - connecting link between cerebrum and medulla and between lobes of cerebellum.
      (4) Medulla oblongata - enlarged upper end of spinal cord, lying just within cranium, contains important nerve centers - controlling action of heart, blood vessels, respiration. Nerves from brain cross over to opposite side of cord. Injury above this causes paralysis on opposite side of body.
   b. Meninges or Membranes.
      (1) Dura mater - lining of cranium and spinal canal, strong, fibrous membrane; protects and suspends the brain.
      (2) Arachnoid - serous membrane, invests the brain and spinal cord.
      (3) Pia mater - very vascular membrane, invests brain deep in the convolutions; supplies blood to brain.
2. Spinal Cord - enclosed in meninges or membrane like the brain - is tail-like column of nervous tissue - composed of nerves - interior-central column gray matter. A pair of nerves leaves it opposite each vertebra (cervical in two groups) each nerve has a posterior (sensory) and anterior (motor)branch. Upper cervical group supplies face and neck and interior chest - important branch - phrenic - diaphragm. Lower group - brachial plexus - supplies upper extremity. Thoracic nerves of dorsal, supply chest wall, lumbar and sacral nerves go to pelvis and lower extremities. All nerves except face pass through spinal cord - severance of cord causes paralysis below that point.
   a. Nerves.
      (1) Motor - convey impulses from brain directing motion - muscle movement, if motor nerve cut, paralysis of muscle.
      (2) Sensory - carry sensation impulses to the brain. If sensory nerve is cut, loss of sensation. Nerves.



MESAL ASPECT OF BRAIN SECTIONED IN THE MEDIAN SAGITTAL PLANE
AND ITS RELATION TO THE SKULL AND FACE



BASAL ASPECT OF THE BRAIN SHOWING SUPERFICIAL ORIGIN OF
CRANIAL NERVES



THE NERVOUS SYSTEM

KNOWN AND PROBABLE SITES OF ACTION OF DRUGS

BILHUBER KNOLL CORP., ORANGE, N. J. Manufacturers of DILAUDID, METRAZOL and THEOCALCIN

Lith. A. Hoen & Co., Inc.

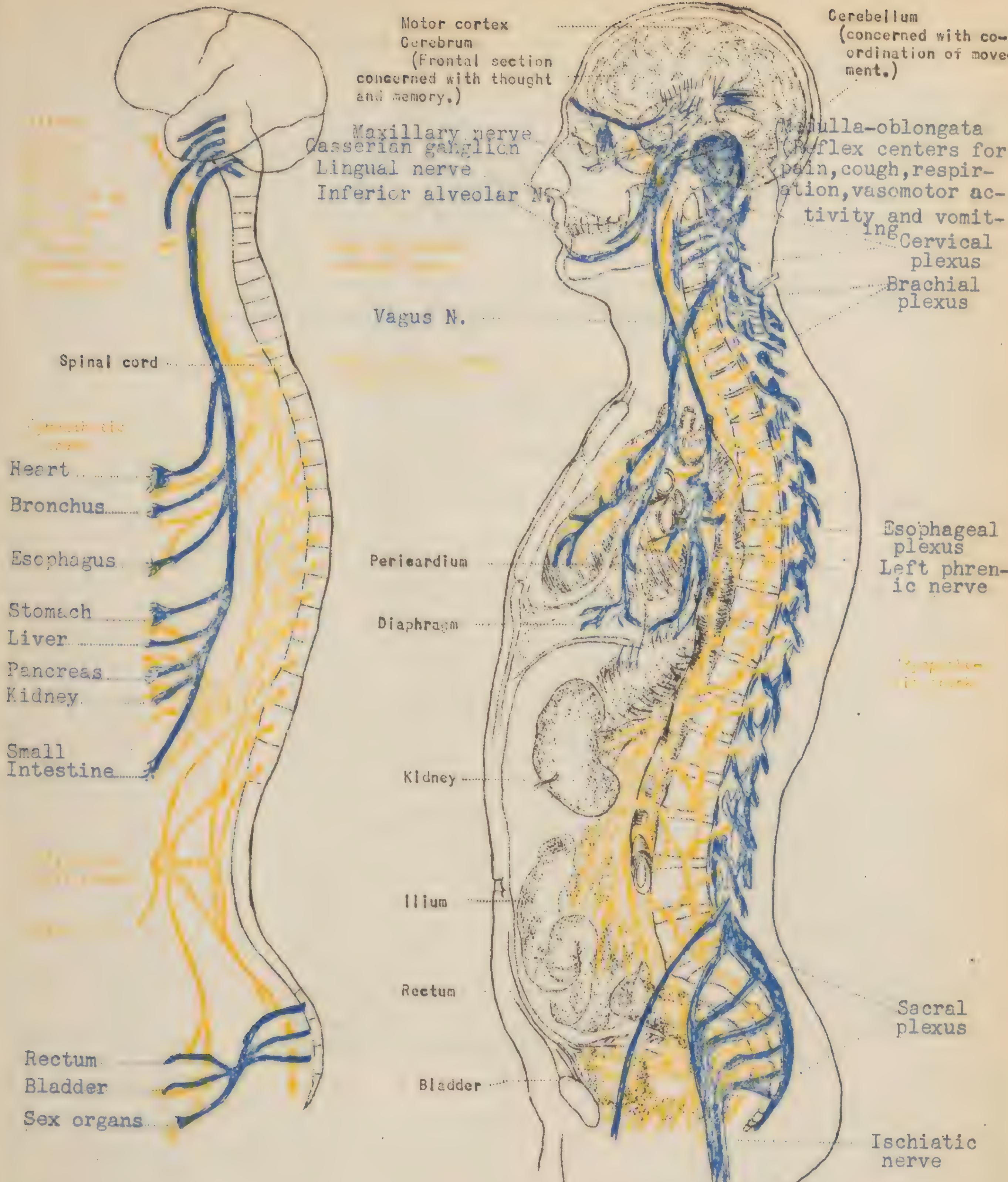


DIAGRAM OF THE AUTONOMIC SYSTEM

Sympathetic nerves- - - yellow
Parasympathetic nerves - blue

Cranial and spinal nerves - - - - blue
Sympathetic nerves and ganglia - yellow

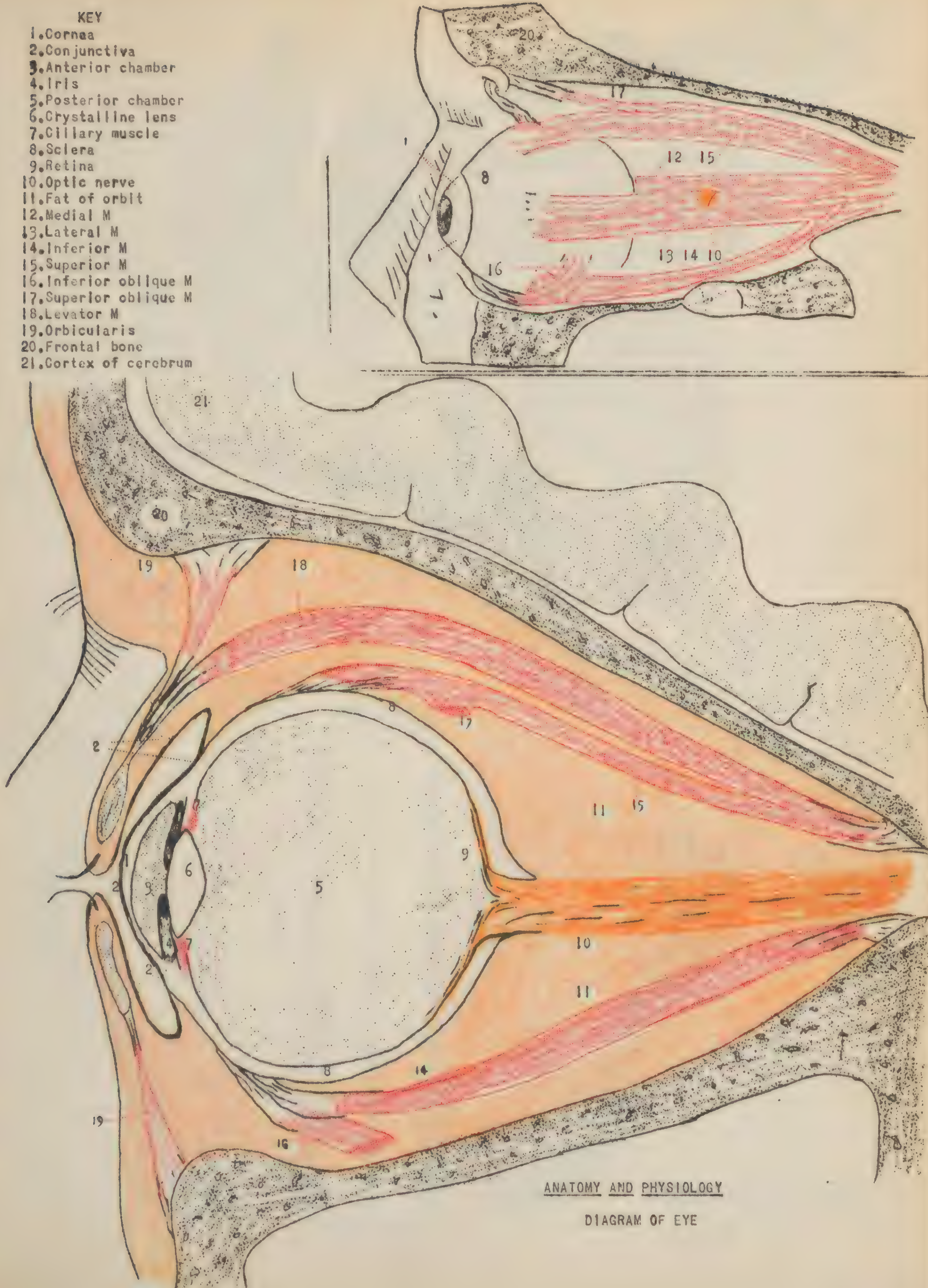
ANATOMY AND PHYSIOLOGY

THE NERVOUS SYSTEM

may be made up of motor and sensory fibers; i.e., 5th nerve. Reflex action - not necessary to refer to brain for action - automatic.

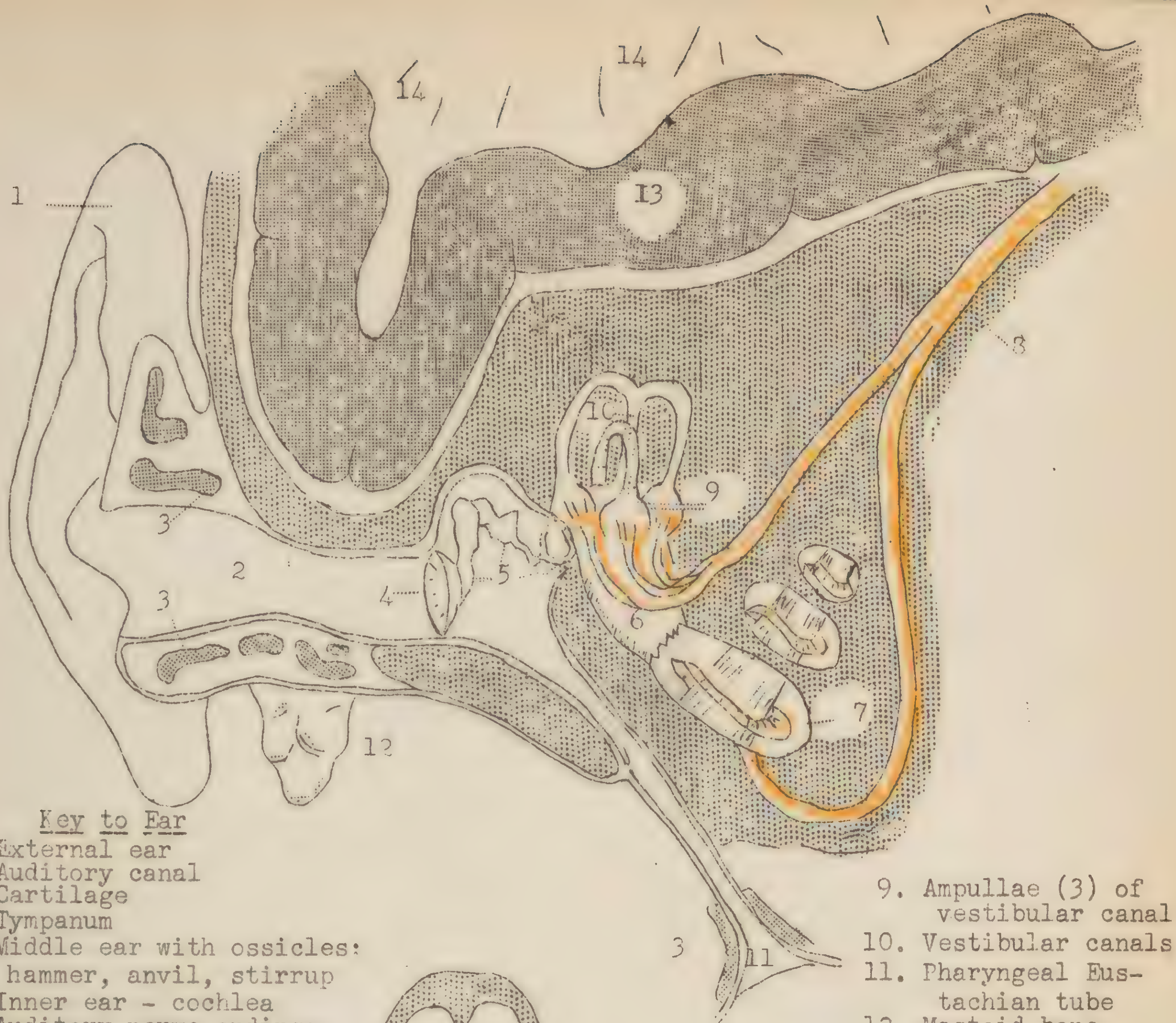
M. Special Senses: touch, taste, smell, hearing and sight. Smell, taste, hearing and sight presided over by special cranial nerves - come directly from brain, not through spinal cord.

1. Touch - skin - more developed - ends of fingers - pain, temperature and pressure.
2. Taste - mouth, tongue, substance should be in solution; sweet, bitter and salt.
3. Smell - nose, upper nasal cavity through olfactory nerve.
4. Hearing - ear, through auditory nerve.
   a. Ear consists of:
      (1) External ear.
      (2) Auditory canal.
      (3) Tympanum or drum membrane.
      (4) Middle ear.
      (5) Small bones (ossicles)
      (6) Internal ear.
      (7) Eustachian tube - leading from middle ear to the throat.
5. Sight - consists in the perception of light, color, form, size and distance, resident - eye.
   a. Eye - situated in the orbit, protected by bony orbit and lids; covered in front by thin vascular membrane, also lines the lids - conjunctiva - light enters through cornea; behind cornea a curtain of muscular fibers, variously colored, the iris. The black pupil is hole through the iris through which the light passes to crystalline lens. Light is focused on retina, retina being an expansion of the optic nerve, which transmits the impression to the brain. The dense white outer coat of eye, beneath conjunctiva is sclera. Eye is like a camera - focusing done by changes in the convexity of lens. Effected by contraction of the ciliary muscle and muscles of accommodation, which when inadequate results in near sightedness or far sightedness - image focuses either in front or behind retina. Distant vision is focused by relaxation of the ciliary muscle - lens widens and thins; close vision is focused by ciliary muscle action - lens thickens from front to rear. Blindness may be due to opacities of eye ball itself; damage to retina, optic nerve or the optic radiation or occipital cortex.



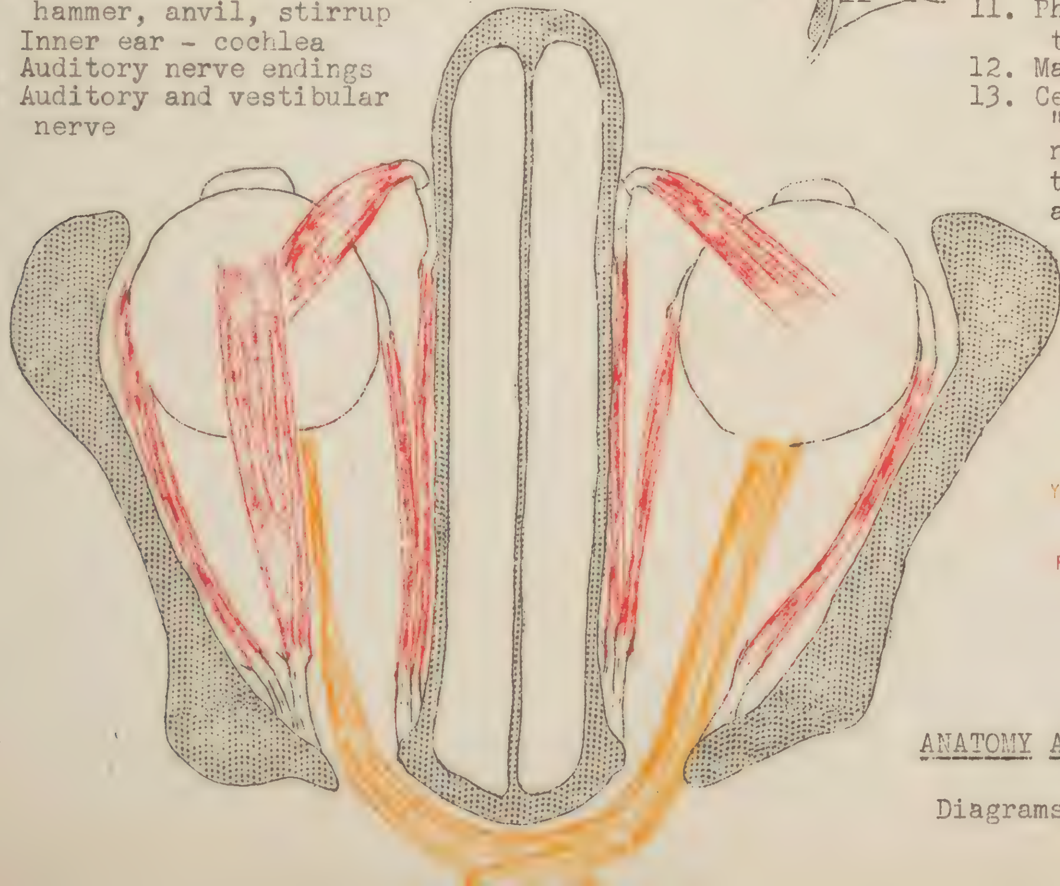
ANATOMY AND PHYSIOLOGY

DIAGRAM OF EYE



Key to Ear

1. External ear
2. Auditory canal
3. Cartilage
4. Tympanum
5. Middle ear with ossicles: hammer, anvil, stirrup
6. Inner ear - cochlea
7. Auditory nerve endings
8. Auditory and vestibular nerve
9. Ampullae (3) of vestibular canal
10. Vestibular canals
11. Pharyngeal Eustachian tube
12. Mastoid bone
13. Cerebral cortex "grey matter"- note convolutions increase area
14. White matter - nerve fibers

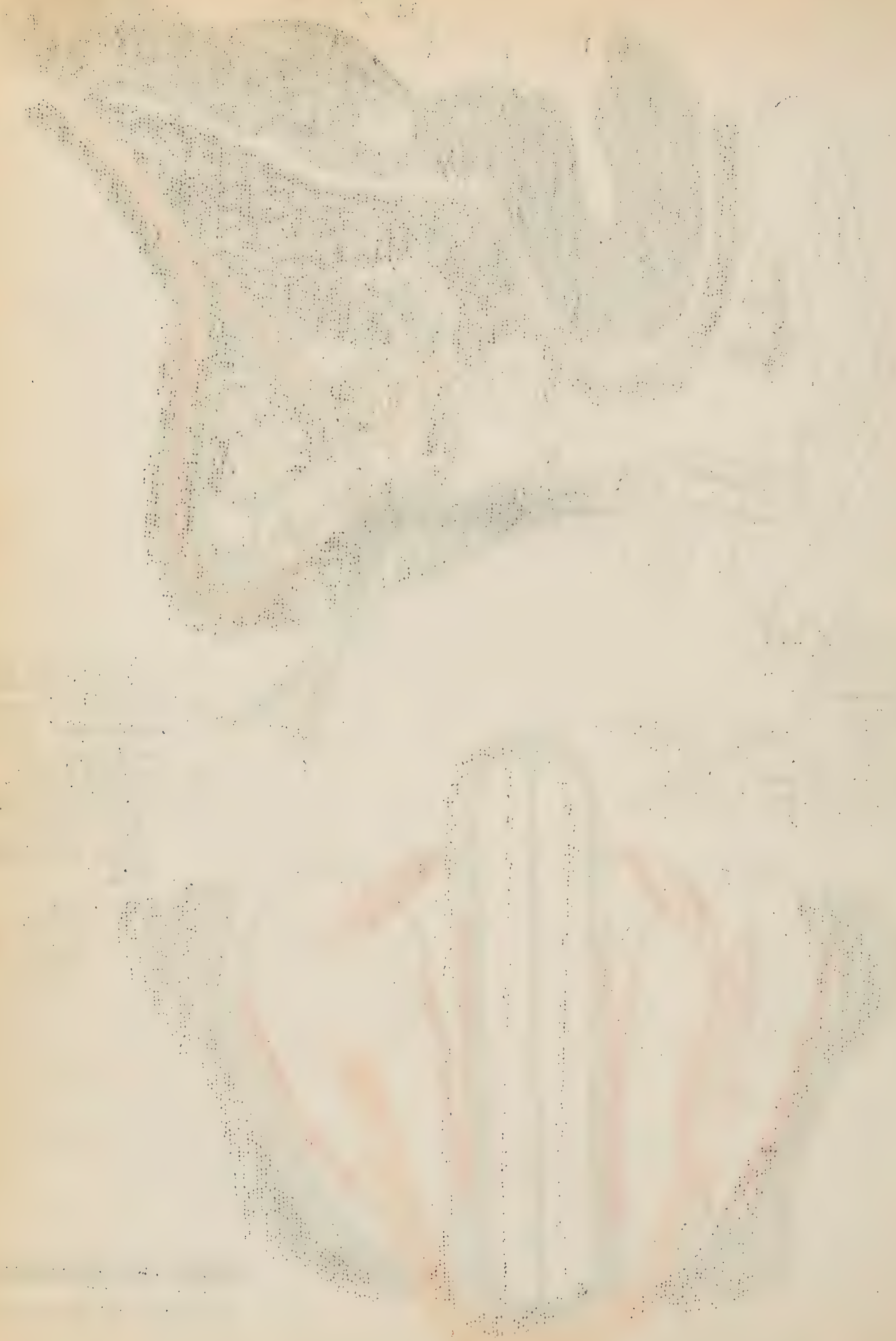


Yellow - Nerves

Red - Muscles

ANATOMY AND PHYSIOLOGY

Diagrams of Ear & Eye



HYGIENE AND SANITATION

HYGIENE AND SANITATION

In the military service we interpret the term "hygiene" as a science having a personal application to an individual and the term "sanitation" as the act of applying the laws of hygiene to groups of individuals.

I. Personal hygiene refers to those measures or precautions which every person should observe for the purpose of maintaining his own health and physical well being. It requires the application of a few common-sense rules, the observance of wholesome habits, and the avoidance of excesses of all kinds.

Hygiene and Sanitation is the preventive medicine which carries out the functions of the Medical Department in the dictum "To Conserve Fighting Strength". This function is performed by selection of healthy men who are thereafter maintained in health; fighting strength by hygiene and sanitation. Care of the sick and wounded is but the second half of the responsibility which occurs when preventive medicine is inadequate.

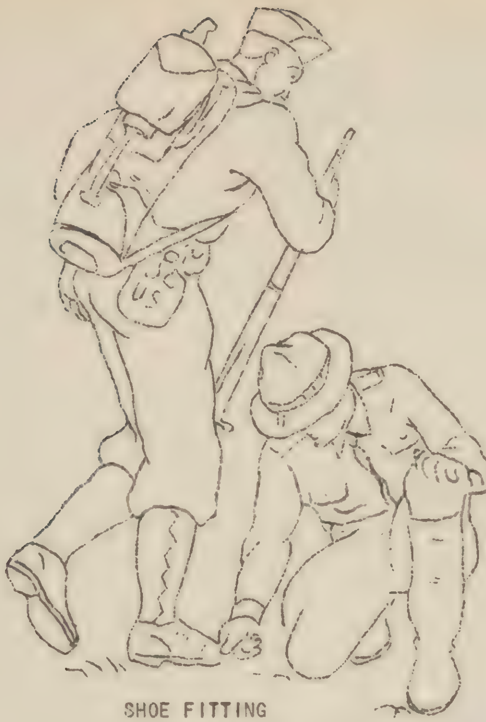
The Commanding Officers are directly concerned with, and responsible for health and strength of their own commands.

The Medical Department is charged with instituting and supervising training in and maintenance of Hygiene and Sanitation.

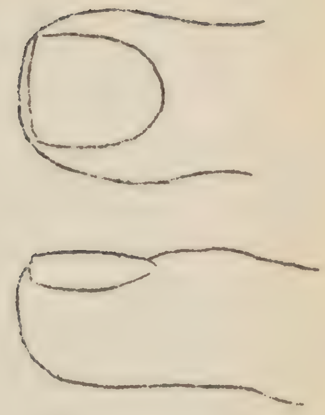
A. Simple Rules for Maintaining Health.

1. Stay away from any person having disease unless it is your duty to care for him.
2. Be sure to use your mosquito bar when mosquitos are present.
3. Flies and cockroaches carry disease and leave it on food. Get rid of flies every way; fly traps, fly paper, fly swatters. Keep doors and window screens closed, garbage cans covered. Scraps of food should be placed in garbage cans and not left lying around.
4. Do not drink any water unless you are sure it is safe and pure. Drink plenty of water at intervals during the day. Don't overdrink, especially when overheated after exertion. Drink from your own glass or cup, or from a bubbling fountain - it is possible to catch disease from other person's pipes, musical instruments, drinking cup, shaving brush, etc. Do not drink or eat in restaurants or soda fountains, unless you are certain they are clean.
5. Bathe frequently, wash hands thoroughly before eating and after using toilet.

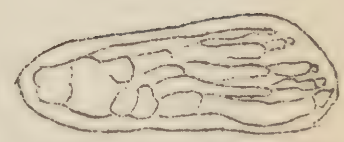
6. Brush teeth once or twice daily and before going to bed. Have dental officer check teeth twice each year.
7. Take sufficient length of time to eat your meals - chew all food thoroughly.
8. Acquire the habit of having bowels move regularly once each day; use toilet to urinate or move bowels. Urine or feces deposited on the ground attracts flies and later flies deposit germs on food, or rain water may carry germs into wells and streams, contaminating water supply.
9. Mattresses and bedding should be hung out in the sun for at least two hours, once each week and more often, if possible. Bed bugs should be watched for and if found, destroyed.
10. All squad rooms must be thoroughly ventilated, especially at night. All such rooms should be thoroughly aired daily.
11. Keep rooms clean. When sweeping them, use something to prevent raising dust.
12. Have your underwear, shirts and socks washed frequently and change them at least twice a week. Be on the lookout for body lice and crab lice.
13. When your clothing or shoes become wet, change as soon as possible. Sitting around in wet clothes or with wet feet is almost certain to give you a "cold" or possibly pneumonia.
14. Wear clothing of proper weight for the climate in which you are serving. Wear an overcoat when outdoors in cold weather. Clothing should fit loosely.
15. Keep your hair cut short and wash it frequently. Keep your fingernails clean.
16. Do not drink intoxicating liquor. It may contain poison such as wood alcohol. Alcoholism leads to sexual indulgence.
17. Avoid venereal diseases. They constitute one of the greatest dangers to which the soldier is exposed.
18. Clothing - protection of body from heat in summer, cold in winter and chilling effects of rain and wind.
    a. Wool - poor conductor of heat and good absorber of moisture; keeps in heat of body in winter and keeps out sun in summer.
    b. Cotton and linen - good conductors and poor absorbers of moisture - excellent in summer.
    c. Color - no influence on temperature of body except in direct sun rays; black and dark colors absorb sun rays; white and yellow reflect them.
    d. Texture - loosely woven material is warmer; hence, warmth of fur and feather.



SHOE FITTING



TOE NAILS PROPERLY CUT



EFFECT OF A SHOE TOO SHORT

CORRECT

TOO WIDE

TOO NARROW

EFFECT OF A POINTED TOE SHOE

CORRECT

TOO SHORT

A GOOD FOOT IN A WELL FITTED SHOE

19. Care of the feet.

a. The most important factor in the marching ability of the soldier is the proper care of the feet. Serious defects of the feet can be prevented by properly fitted shoes and socks. Sore feet are generally due to carelessness, neglect or ignorance.

(1) Shoes: only field shoes issued by the Q.M. should be worn in the field by the soldier, and they must be properly fitted. Don't wear new shoes on a march; break shoes in first.

(2) Socks: only woolen socks should be worn for marching. Cotton socks shouldn't be worn for marching unless ordered by Medical officer. Socks should be large enough to permit free movement of the toes, but not so loose as to permit wrinkling. Darned socks or socks with holes are not fit for marching.

(3) Clean feet are important. Feet should be washed and socks changed each day; especially important on a march. After a march, feet should be washed and clean socks put on, and shoes changed. Until feet are hardened, dust with foot powder before and after each day's march; applying lard to the feet before a march may prevent irritation of the feet.

(4) If blisters have appeared on the feet, they should be painted with iodine and emptied by pricking them at the lower edge with a pin which has been passed through a flame. Serious abrasions should be treated at dispensary or aid station.

(5) Toe nails should be kept short and clean. Should be cut straight across and not on a curve.

(6) Ringworm or "Athlete's Foot" - foot infection. Prevention is most important, but when cases develop, thorough treatment should be administered.

B. <u>Rules for Avoiding Disease during Field Service</u> - The following rules apply in the field and equally as well in permanent camps or stations.

1. Do not drink water which has not been declared potable or pure by a Medical officer.
2. Do not soil ground with stools or urine. Use latrine.
3. Be sure mess kit is washed in soapy water after being used.
4. Use mosquito bar in regions where mosquitos are present.
5. Do not sit or lie directly on damp ground.
6. Ditch the tents as soon as put up.
7. Prepare bed before dark.

8. Never use cups, pipes, cigars, gas masks, etc., which are used by others.
9. Where a supply of water is adequate, drink plenty. On the march, use sparingly. Don't drink large quantities of water when overheated.
10. Move bowels daily.
11. Wear clothing of proper weight for the climate.
12. Keep hair cut short and fingernails clean.
13. Never throw pieces of food or refuse around camp.
14. If possible, avoid all contact with diseased persons.
15. Avoid venereal diseases.

II. Communicable Diseases

A. Definition: communicable diseases are those diseases which can be transmitted from one person to another. The term, "communicable", is synonymous with "infectious", "contagious" or "epidemic disease".

1. Importance: this group accounts for a considerable part of the admissions to sick report, both in peace and in war.
2. Cause: by the growth on or within the body by certain organisms commonly called "germs" or by viruses.
3. Classification.
    a. Respiratory - those diseases in which the casual agents are eliminated in discharges from the mouth, nose, throat and lungs.
    b. Intestinal - those diseases in which the causal agents are eliminated in the urine and feces.
    c. Insect-borne - those diseases which are transmitted by blood-sucking insects.
    d. Venereal - those diseases which are usually transmitted during sexual contact.
    e. Miscellaneous - those diseases which are preventable but which do not readily fall into the above groups. Among these are tetanus, (lockjaw), rabies (Hydrophobia), scabies, trichophytosis (ringworm) and anthrax.
4. Spread of Communicable Diseases.
    a. Sources
        (1) Case - person actually ill with a disease.
        (2) Carrier - a person who, although not ill, is giving off from his body organisms capable of causing disease - typhoid, diphtheria, etc.
        (3) Animals - infected animals - Rocky Mountain Spotted Fever.
        (4) Blood sucking insects - mosquitos, lice and ticks - transmit causal agent or disease from person to person.
    b. Transmitting agencies.

(1) Contact - either by direct contact or close association between a case or carrier, and one who is susceptible to the disease. Respiratory and venereal diseases are usually transmitted by contact.
(2) Water and food - causal organism eliminated from the body in the feces and urine of case or carrier, and through water and food transmitted to susceptible individual. Intestinal diseases are transmitted through water and food.
(3) Unusual or Multiple Agencies - many diseases are usually transmitted by indirect contact, and are also transmissible by food and water, or vice versa. Diseases that may be transmitted by food and water, as well as by hands, mess kits, etc., are diphtheria, septic sore throat, scarlet fever, tuberculosis, typhoid and paratyphoid, dysentery and diarrhea.

5. Susceptibility and Immunity
   a. A susceptible person is one who will develop the disease if infected with specific organisms or viruses.
   b. A person is immune to a given disease when the tissues of his body have developed the power to combat and overcome the specific organisms or viruses.
   c. An individual may be rendered immune or non-susceptible to certain diseases by an attack of the disease. Examples: scarlet fever, measles, mumps, etc.
   d. Vaccination against small pox and typhoid fever renders immunity to those diseases for a limited period and then vaccination must be repeated.
   e. Natural immunity is the ability to overcome small doses of disease organisms and not develop the disease.
   f. An attack of a disease or vaccination gives only temporary immunity in many of the communicable diseases.
6. Control of Communicable Diseases
   a. Control of sources - supervision of cases and carriers with a view to preventing the transference of the causal agents to others.
   b. Control of transmitting agencies.
      (1) Proper ventilation of barracks and tents.
      (2) Prevention of overcrowding.
      (3) Purification of water.
      (4) Proper sanitation of messes.
      (5) Proper waste disposal.
      (6) Control of disease bearing insects.

c. Protection of susceptibles
   (1) Improve health of all individuals.
   (2) Vaccination against small pox, typhoid fever.
d. Individual education: instruction of all individuals in the fundamentals of personal hygiene and the rigid observance by them of its rules.

III. Respiratory Diseases are more prevalent in winter and spring, and when large groups of recruits are assembled. They spread in the secretions of the respiratory tract and may be transmitted through air, hands, food, mess equipment or any other substances which come in contact with secretions of the mouth and nose.

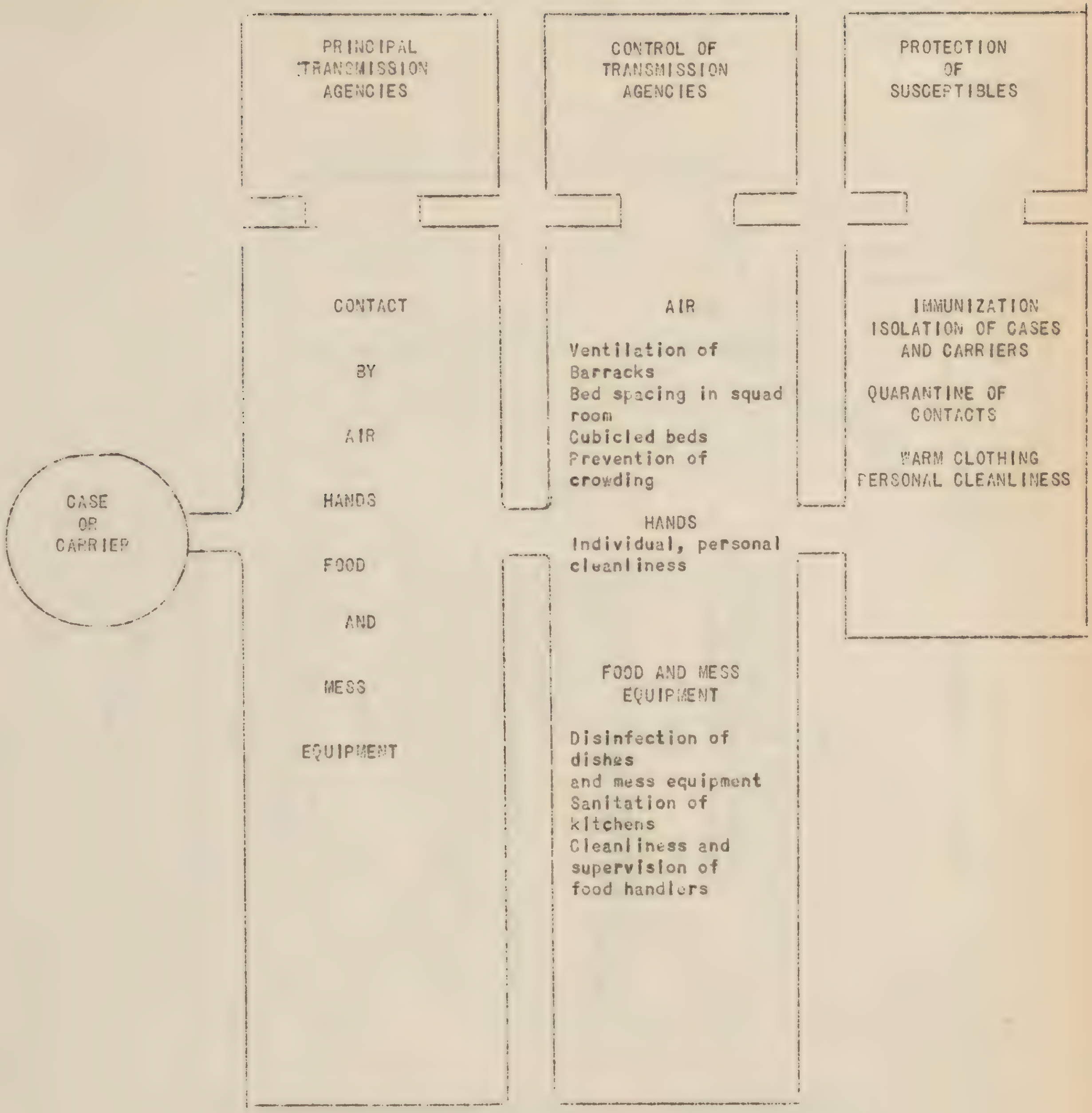
A. Classification.

Mumps, measles, diphtheria, scarlet fever, common respiratory diseases (cold, acute laryngitis, acute tonsillitis and acute bronchitis), influenza, pneumonia, meningitis (cerebrospinal), pulmonary tuberculosis, whooping cough, plague and poliomyelitis.

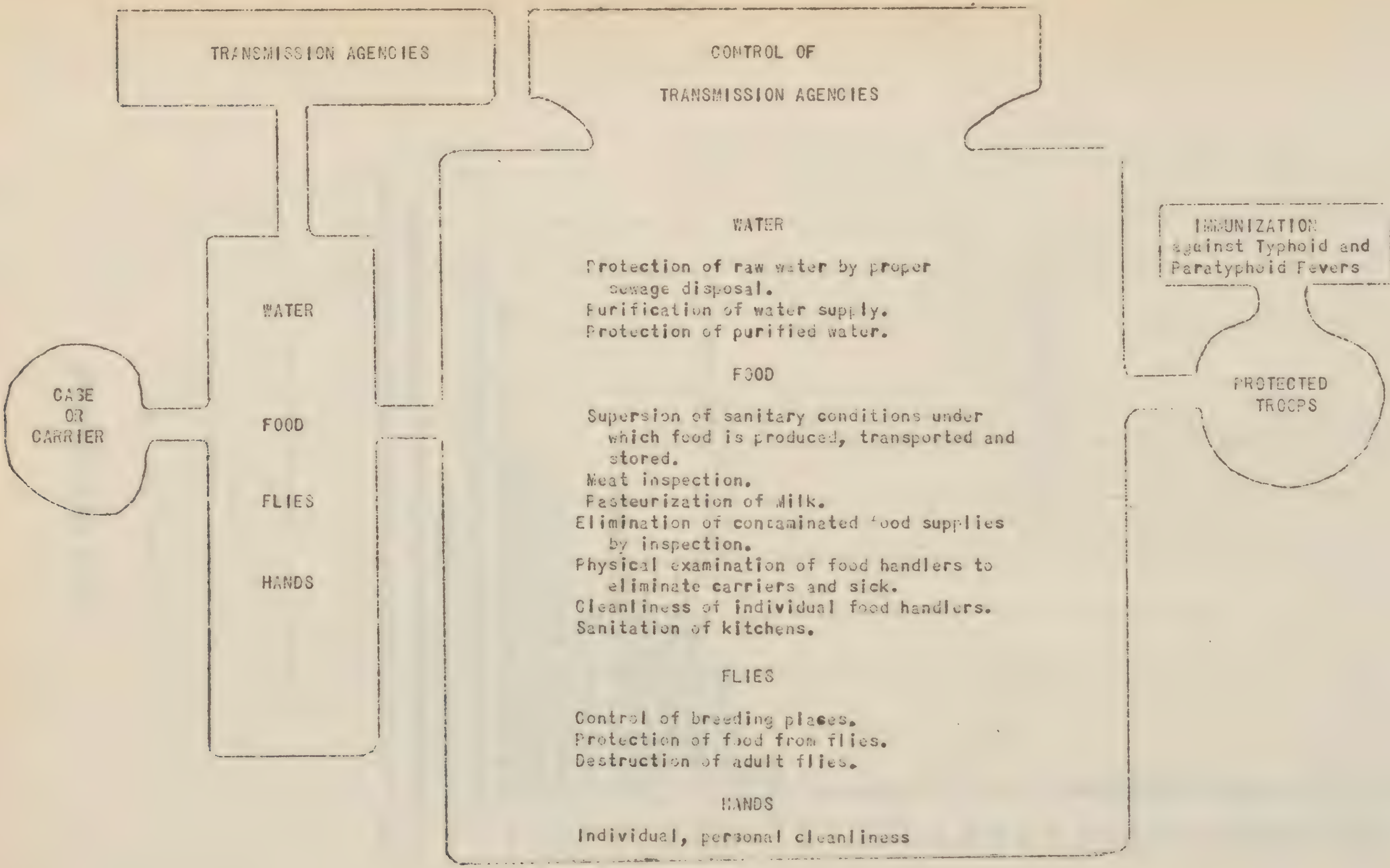
B. Control Measures

1. Proper ventilation.
   a. Ventilation is the adjustment of atmospheric conditions so as to promote health, comfort and efficiency.
   b. The ill effects of poor ventilation above are due to heat, moisture and stagnation of the air surrounding the body.
   c. Proper ventilation of an occupied barracks or quarters requires that the air be moved through the room; there must be a proper balance between heat, moisture and air movement, to effect good ventilation.
2. Proper bed spacing.

   In barracks each man should have a floor space of 60 sq. feet and an air space of 720 cubic feet. Place beds so that sleeping occupants will not spray secretions from nose and throat. Cubicles are made either by screens, sheets or shelter halves.
3. Prevention of overcrowding; the control of crowding or close contact is the most important factor in the control of respiratory diseases.
4. Barracks and tent cleanliness.
   a. Certain sanitary precautions are essential to cleanliness and the following should be prohibited.
      (1) Spitting on the floor.
      (2) Dry sweeping of the floors.
      (3) Careless coughing and sneezing.
      (4) Use of common towel and drinking cup.
5. Suitable clothing and bedding: fatigue or chilling will in many instances lower the resistance of the individual. Sufficient bedding to prevent chilling of the body must be used.
6. Mess sanitation: mess gear and utensils should be thoroughly sterilized.



<u>GENERAL FACTORS IN THE CONTROL OF RESPIRATORY DISEASES.</u>



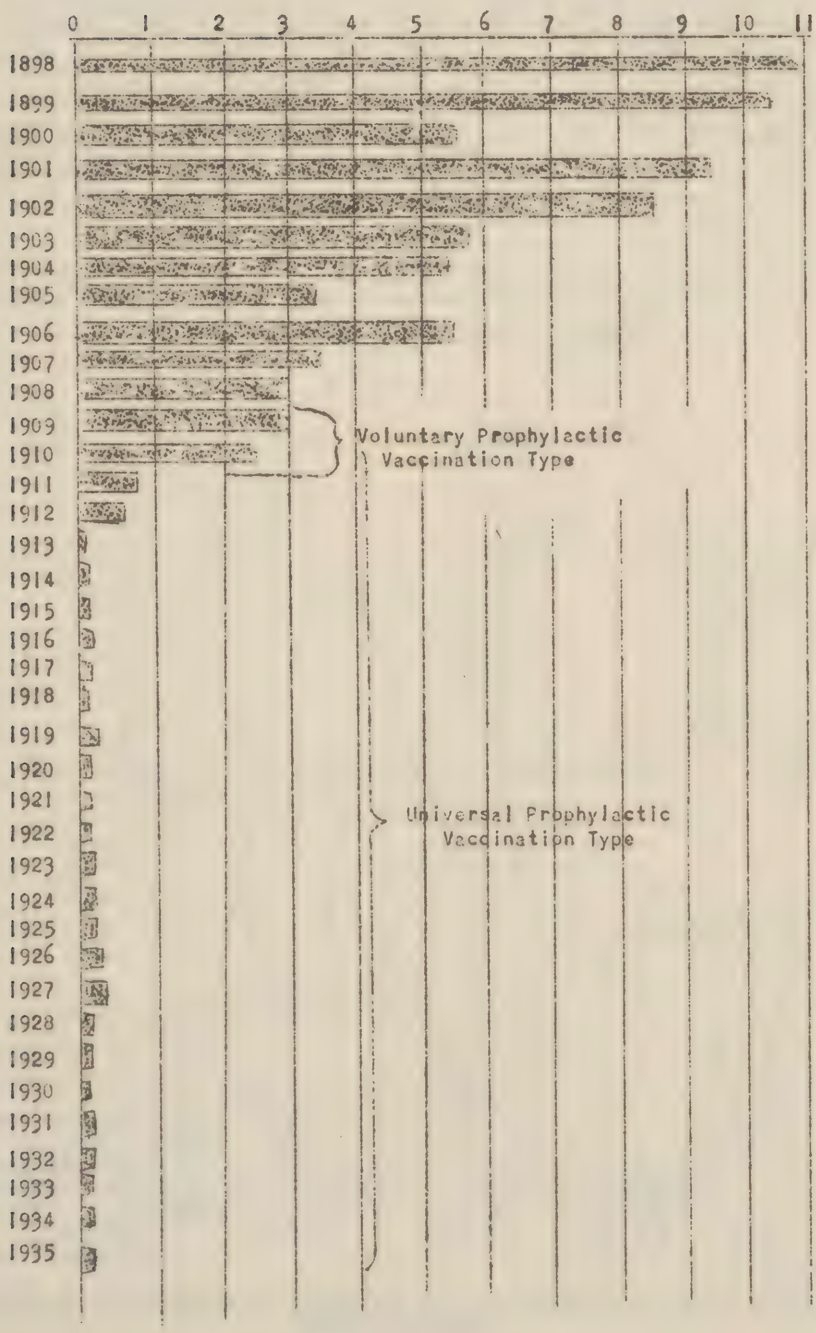
GENERAL FACTORS IN THE CONTROL OF INTESTINAL DISEASES.

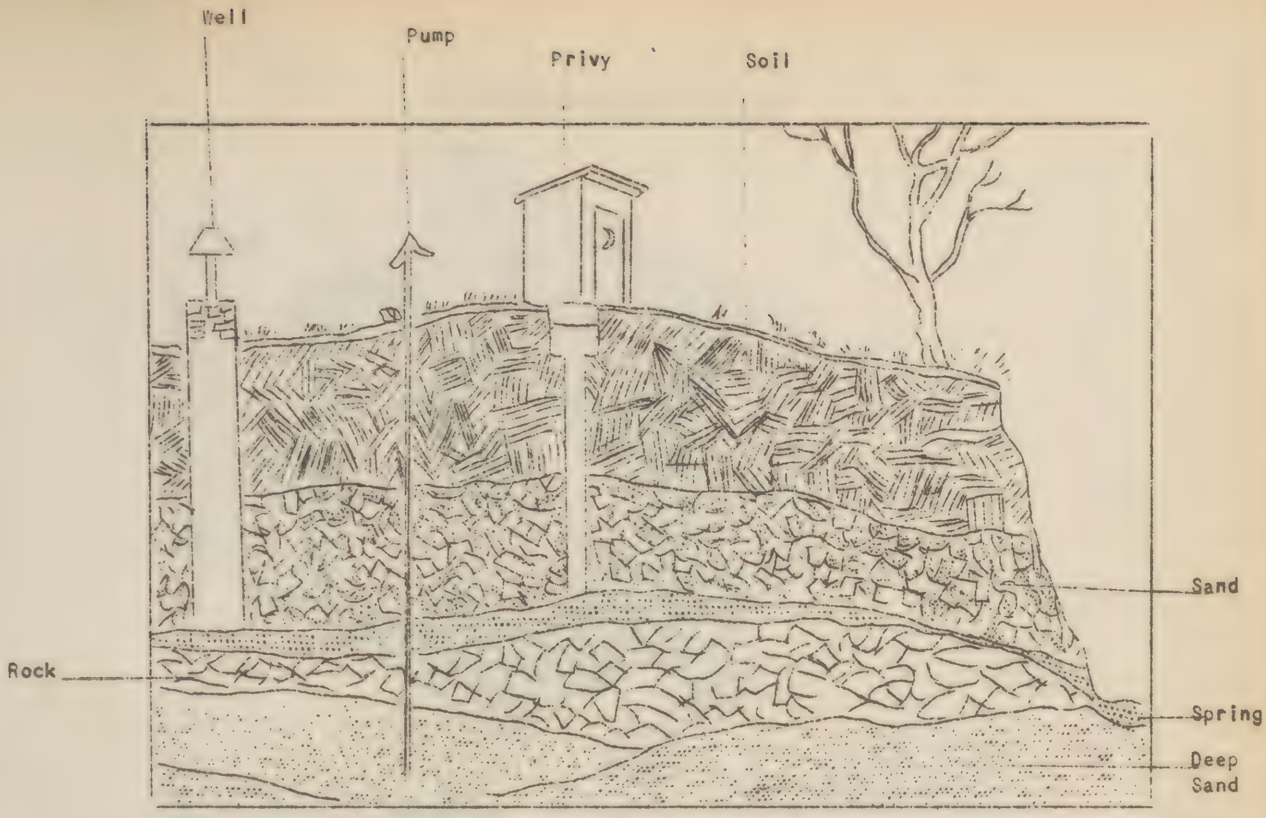
TYPHOID FEVER ADMISSIONS

By Years: 1898 - 1935

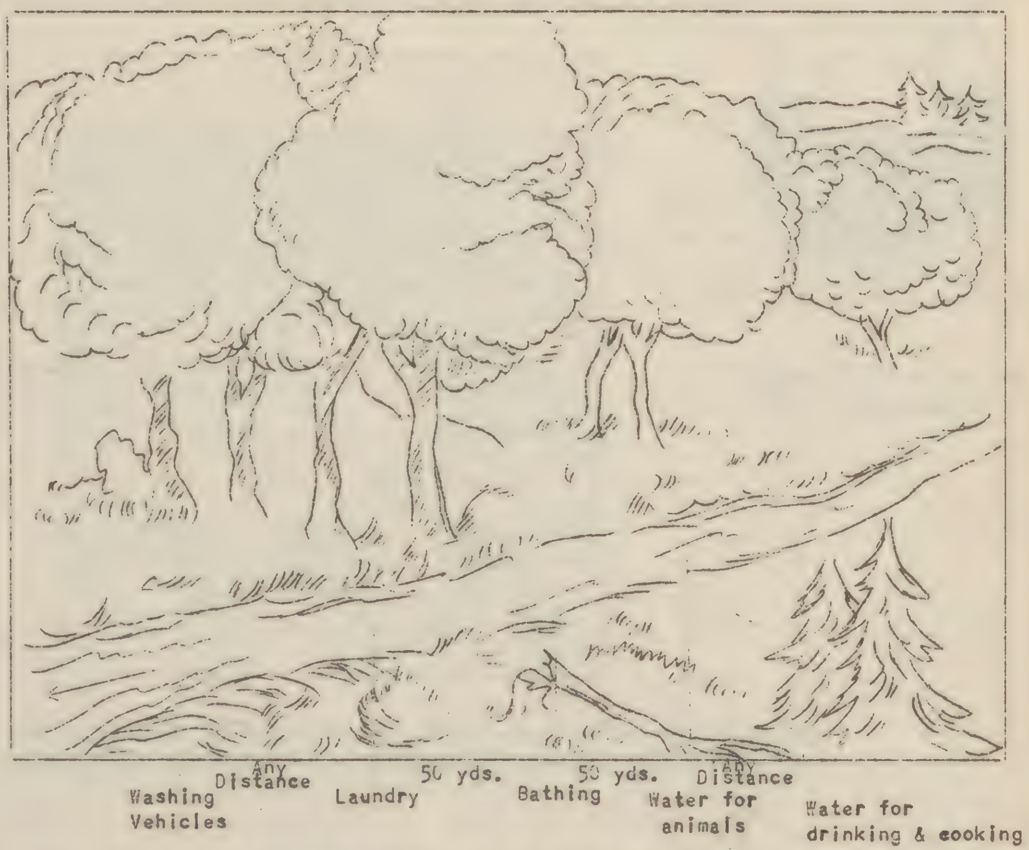
Enlisted Men in United States
Army

Rates Per 1000 Strength Per Annum

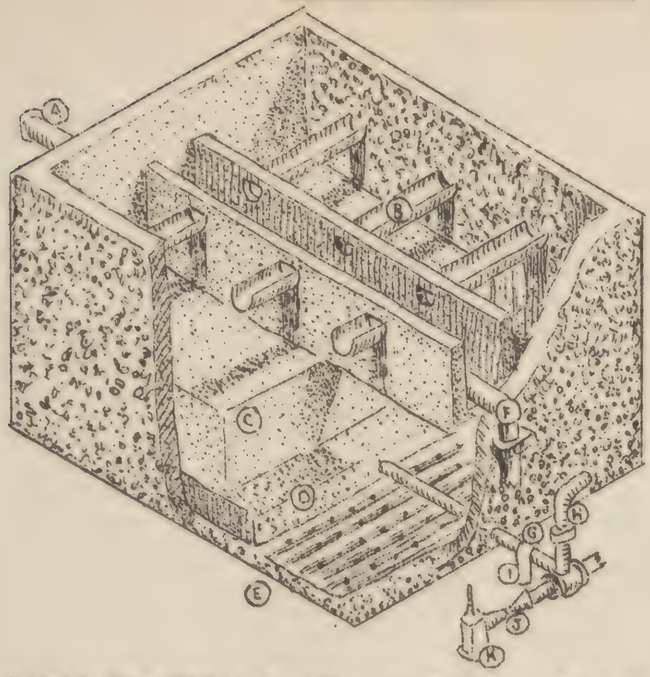




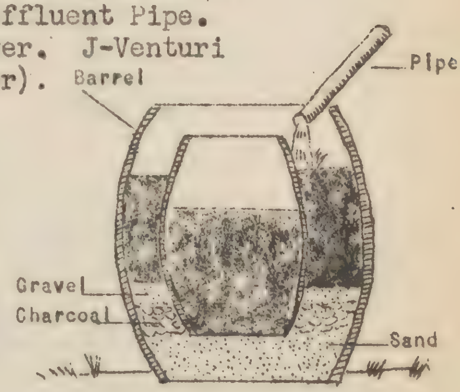
POLLUTION OF WELL BY SEEPAGE FROM PIT PRIVY



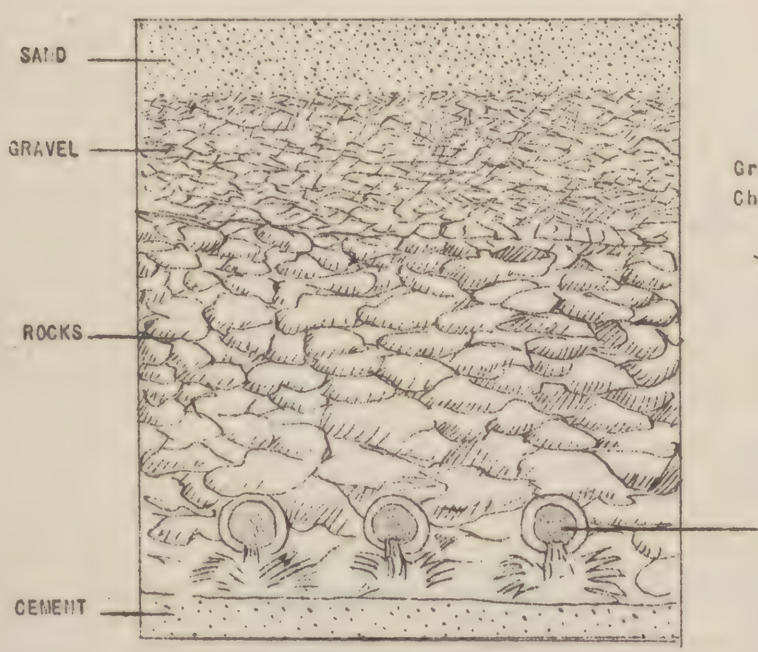
PROTECTION OF WATER SUPPLY BY PROPER USE OF STREAM FROM WHICH WATER IS TAKEN FOR VARIOUS PURPOSES.



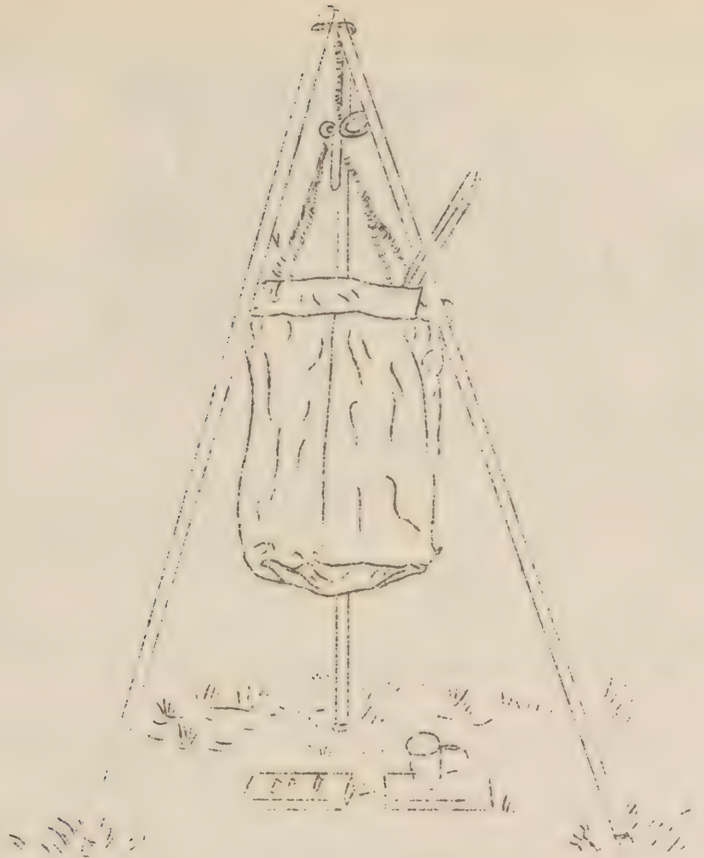
Rapid San Filter Unit. A-Inlet. B-Wash Water Troughs. C-Sand Bed. D-Gravel Layer. E-Under Drain (Strainer) System. F-Waste Water Drain Pipe. G-Effluent Pipe. H-Wash Water Pipe. I-Drain Pipe to Sewer. J-Venturi Tube. K-Effluent Valve (rate controller).



Simple Filter using two barrels.



Diagrammatic section of rapid sand filter showing perforated lateral drains delivering wash water.

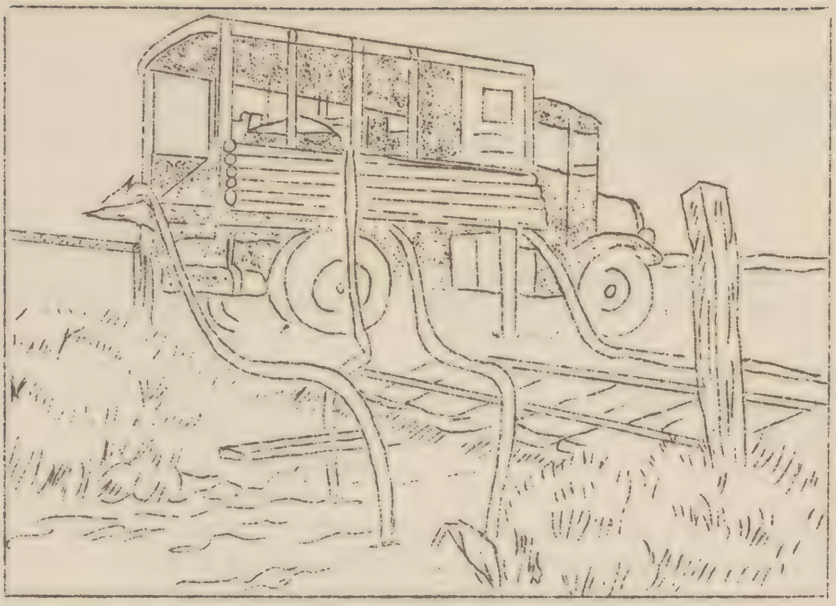


WATER STERILIZING BAG.

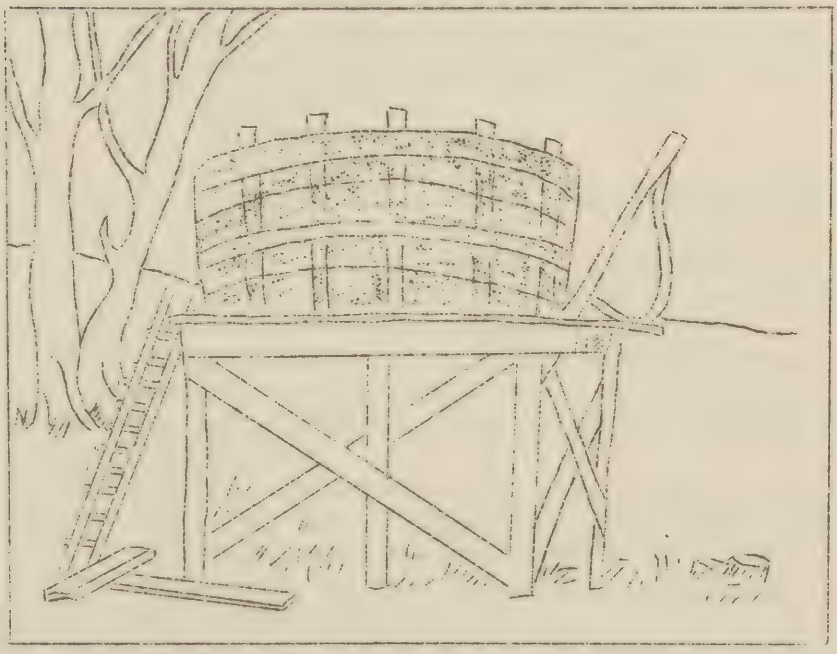
1. The technique is as follows:
   a. Fill the bag, suspended on a tripod, to within four inches of the top.
   b. Draw a small quantity of water through one of the faucets into a canteen cup.
   c. Break an ampule of calcium hypochlorite into the canteen cup, stir with a clean stick until a thin paste is formed, then fill the cup two-thirds full of water.
   d. Empty the above solution into the water bag and stir thoroughly with a clean stick long enough to reach to the bottom.
   e. Draw about 1/3 canteen cup of water from each of the faucets and pour it back into the water bag.
   f. Wait ten minutes, then wash out one of the faucets by allowing a small amount of water to run through onto the ground. Fill a clean canteen cup 2/3 full of water from the same faucet.
   g. Add one cc. (15 drops) of orthotolidine testing solution to the water in the cup. Wait 2 minutes and note the color produced. Below is a guide for reading the reaction between free chlorine and orthotolidine:

      No color - insufficient chlorine. Add more calcium hypochlorite.
      Canary Yellow - insufficient chlorine. Add more calcium hypochlorite.
      Deep Yellow - Satisfactory chlorination, being about one part per million (ppm) of chlorine.
      Orange Red - Over-chlorinated; add more water and retest.
      Bluish Green - Alkaline or hard water. Add few more drops of orthotolidine to get a correct color reading.

   h. Allow to stand 30 minutes after satisfactory chlorination has been accomplished. The unpleasant taste of over-chlorinated water is diminished by allowing it to stand several hours before using. It is a good plan to chlorinate water in the evening for the next day's use.



MOBILE WATER PURIFICATION UNIT SHOWING INLET HOSE AND THE FILTER WASTE LINE.



ELEVATED WATER STORAGE TANK FOR USE IN THE FIELD WITH THE MOBILE PURIFICATION UNIT. THIS TANK HOLDS APPROXIMATELY 400 GALLONS OF WATER.

7. Recruits: incoming recruits should be kept apart from other troops at least 2 weeks.
8. Hospitalization: all cases of illness with symptoms accompanied by a temperature of 100° F., or above, will be suspects and hospitalized.
9. Immunization: with the exception of diphtheria and scarlet fever, the present status of immunization against other diseases in this group is one of experimentation.

IV. Intestinal Diseases

A. Definition: the intestinal diseases are those in which the causal agents are eliminated from the body in the feces and urine.

B. Classification: typhoid fever, paratyphoid fever, common diarrhea, bacillary dysentery, protozoal dysentery, cholera, helminthic infestations (worms), undulant fever, food infection, botulism.

C. Control Measures:

1. General: effective control of intestinal diseases is based on the control of environmental conditions with a view to preventing the transmission of the causal organisms by water and food.
2. Routine measures.
   a. Purification and protection of water supplies.
   b. Proper inspection and protection of food supplies.
   c. Proper mess sanitation - physical examination of food handlers.
   d. Proper waste disposal.
   e. Fly control.
   f. Immunization - typhoid and paratyphoid, cholera, bacillary dysentery.
   g. Rigid personal hygiene of all individuals.
   h. Rigid discipline in matters of sanitation.

D. Concurrent and Terminal Disinfection.

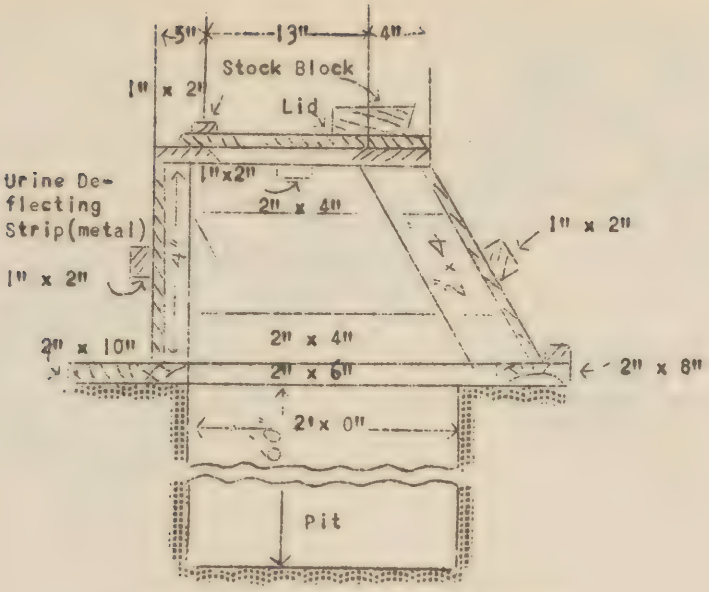
1. Feces and urine of patients with intestinal diseases must be disinfected.
2. Any article which might be soiled by excreta must be disinfected.
3. Patients should have separate dishes and eating utensils should be boiled after use. Food left over by these patients should be destroyed.
4. All sheets, pajamas, towels or similar articles should be disinfected.
5. Terminal disinfection should consist generally of thorough cleaning of ward or room and disinfection of the bedding.

E. Water and its Purification.

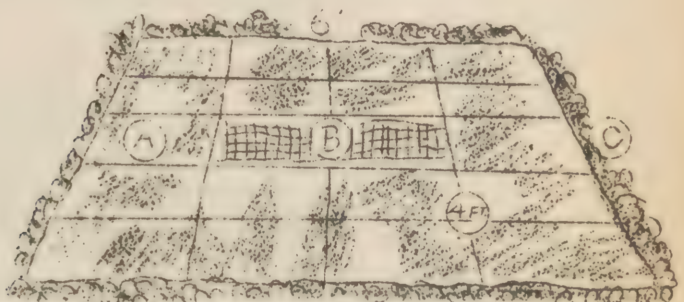
1. Amount of water needed by average man varies according to exercise, temperature, etc. In the field or temporary camp, 2 to 5 gallons per day per man are required. In permanent camp, it varies from 50 to 200 gallons per day.

2. Water Source.
   a. Surface waters - ponds, rivers, small streams.
   b. Ground water - wells or springs.
3. Purification.
   a. Boiling or distillation.
   b. Chemical treatment - chlorination or use of iodine.
   c. Filtration.

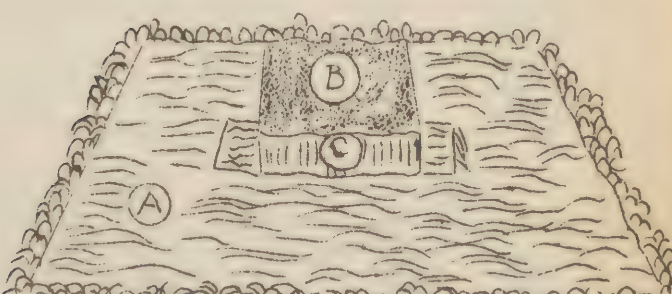
F. Disposal of Wastes: essential in the control of communicable diseases, especially intestinal group.
1. Classification:
   a. Human wastes - excreta, solid and liquid and bath water.
   b. Kitchen wastes - liquid and solid.
   c. Animal wastes (manure)
   d. Rubbish.
2. Disposal of human wastes: most important in transmission of intestinal diseases.
   a. Latrines - seats or space are provided to accommodate 5 to 10% of the command at one time, each man allowed 2 feet of latrine space.
   b. Latrines should be flyproofed.
   c. Latrines should not be dug below ground water level, or dug in clay, as liquids are not absorbed.
   d. Disposal by drying. Dried in sunlight and when dry, removed, burned or used to fill low areas.
   e. Composting: is the close packing of manure on a platform. It is recommended for semi-permanent camps. The efficiency of this method is due to the heat generated within the center of the manure pile which is 140° F. to 160° F. Thereby, fly larvae are destroyed, (fly larvae being killed at 115° F.)
   f. Burning: requires large amount of wood and oil unless manure is thoroughly dried; impracticable in wet climate.
4. Disposal of Kitchen Waste.
   a. Kitchen waste consists of the food remnants accumulated after meals and in the preparation thereof, as well as the water in which the kitchen utensils and mess gear have been washed. Solids, 1/2 lb. per person per day; liquids 200 to 1000 gallons per company of 200 men per day, are averages.
   b. Garbage Disposal.
      (1) Burial: on march or bivouac, in trench 2 to 3 feet deep, which should not be within 100 feet of any source of water used for drinking or cooking.
      (2) Sale or gift: may sell or give garbage to farmer. Must be divided into edible and non-edible portions at the kitchens. Non-edible articles are: coffee grounds, tea leaves, eggshells, banana peels and stalks, fish heads and scales, citron rinds, tin cans, paper and other rubbish.



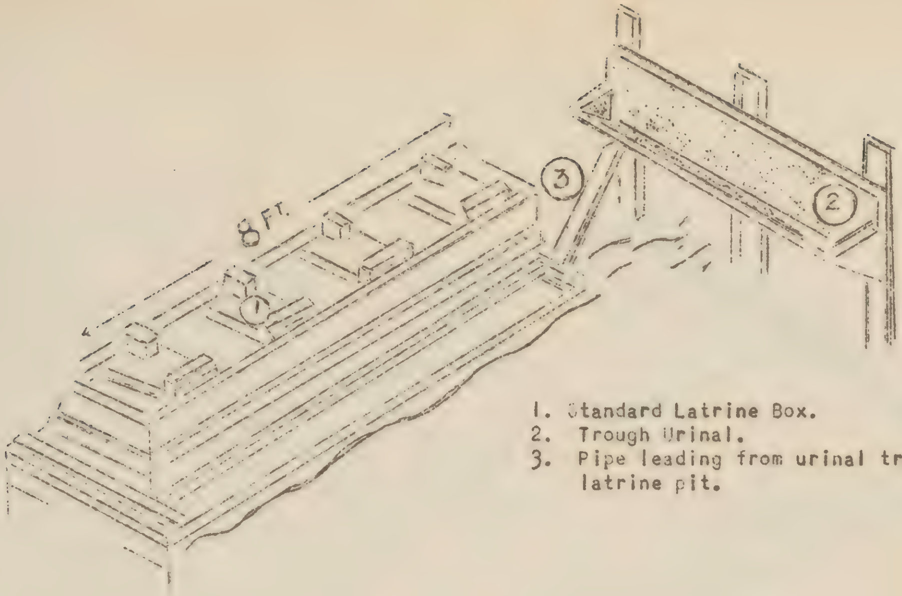
LATRINE BOX SHOWING DIFFERENT SECTIONS.



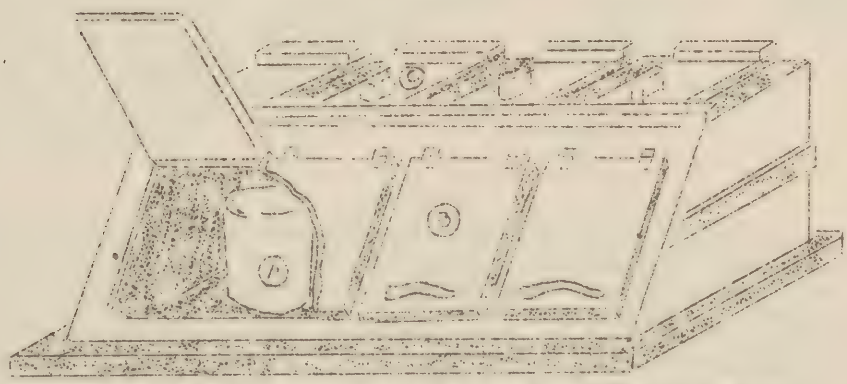
FLYPROOFING LATRINE PIT. A- Oil soaked burlap extending completely around pit; B - opening of pit; C - sidewall of excavation in which burlap is placed.



METHOD OF FLYPROOFING LATRINE PIT WITH OILED BURLAP. A - Layer of earth replaced and tamped down over oil soaked burlap; B - oiled burlap exposed before replacement of earth; C - opening of pit.



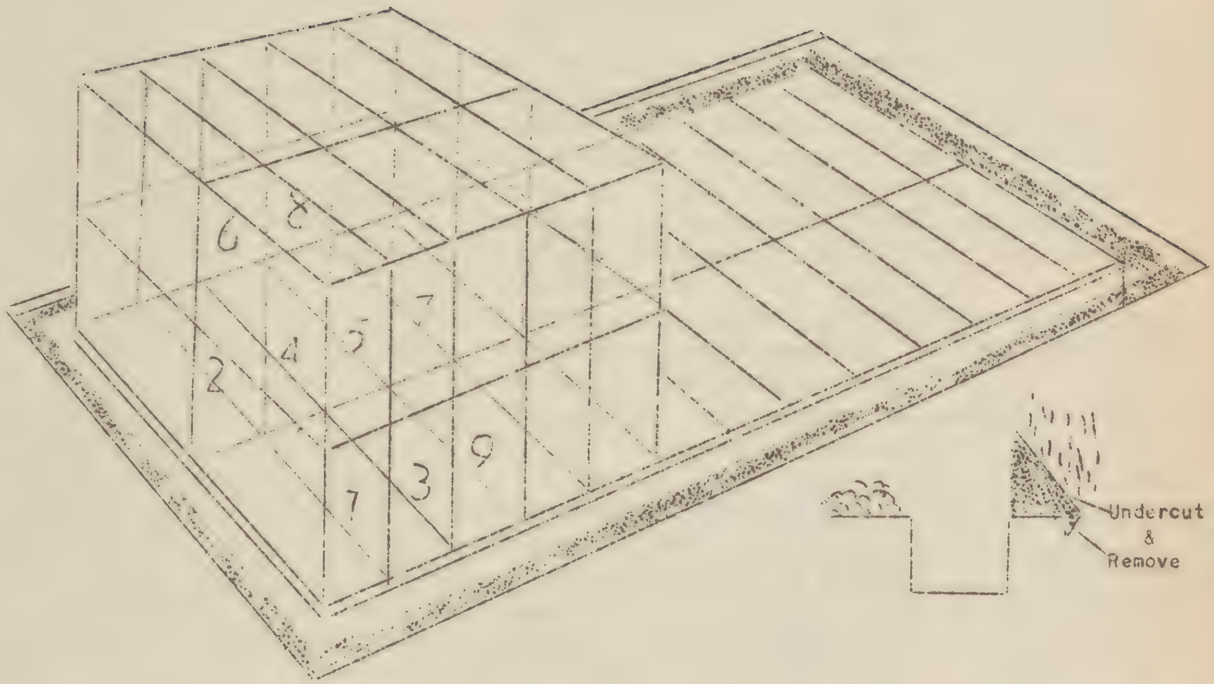
1. Standard Latrine Box.
2. Trough Urinal.
3. Pipe leading from urinal trough to latrine pit.



METHOD OF ADAPTING STANDARD LATRINE BOX FOR USE AS PAIL LATRINE.

A. Latrine Pail B. Hinged Doors C. Self-closing Lids.

STRADDLE TRENCH LATRINE



COMPOST PLATFORM - - This platform is constructed by leveling off an area of ground, 50 feet long, and 20 feet wide, digging a trench around the area, 12 inches deep with vertical sides, Constructing a second trench, very shallow, not over 3 inches deep and 4 inches wide, and located just within the edge of the platform. The manure is placed on the platform as follows: Beginning at one corner, place the manure on an area 3 1/2 ft. long and 10 ft. wide, piling it to a height of 4 to 5 feet, packing it down very tightly and dressing the sides neatly. The sides must, at all times, be kept vertical. The second day's supply of manure is placed on the adjacent corner in a similar manner. On the third day, the supply of manure is placed immediately adjacent to the first pile and on the fourth day, adjacent to the second pile and on the fifth day the supply is piled on top of the first pile. The manure is thus placed on the platform in the succeeding small sections, as shown in the diagram. This is done for the purpose of confining the fly breeding to the smallest possible area. The manure should be kept moist so as to promote decomposition. The sides of the pile should be sprayed daily with a mixture of cresol, kerosene and fuel oil. Crude oil or a light road oil is used in the trenches, the earth in the trench being kept visibly moist with oil. In the preparation of the platform, all vegetation should be removed for a distance of 2 feet from the edges, the earth here tamped down firmly and oiled thoroughly; similarly, the earth beyond the trenches should be freed from vegetation, packed down and oiled. The trenches are to be kept clean at all times. A platform this size should care for the manure of 100 animals for two months.

(3) Hog feeding: this is not feasible unless there are at least 500 troops in camp for considerable period of time. This will care for 10 to 15 hogs.
(4) Reduction: cost of reduction plant renders it impracticable for camp or cantonment.
(5) Close incineration: closed incinerators are of two types: low temperature - 1400° F. and high temperature - 1800° F.
(6) Semi-closed incinerator: is more easily built than closed type, and is protected from rain and wind. Incline plane incinerator - a type, semi-closed and will consume the garbage from about 1000 troops and is easily constructed.
(7) Open incinerators: garbage may be disposed of by open incineration. The multiple shelf or rock pile incinerators.
(8) The company incinerator of choice is the barrel and trench incinerator: this consists of a barrel-like stack which is placed over the intersection of two cross trenches, 1 foot wide, 10 feet long, cross at right angles. The trenches slope from surface of ground at each end to 18 inches at center of intersection. Other types of company incinerators are: rock pit which is not economical to operate on account of fuel consumption; the drying pan incinerator may be used if it is difficult to dispose of liquid kitchen wastes.
(9) Garbage collection and stands: garbage should be collected in standard galvanized iron cans with tightly fitting lids. In semi-permanent camps garbage stands should be built adjacent to the kitchens and on solid concrete blocks.

5. Disposal of Liquid Wastes.
   a. Where sewers are available, liquid kitchen wastes may be disposed of by dumping into sewers. Most camps find this is not possible, so liquid waste must be disposed of in the soil; to prevent clogging and to facilitate absorption, greases should be removed before being discharged into pit or trench.
   (1) In bivouac: liquids are disposed of in trenches or pits.
   (2) Soakage pits: same as urine soakage pit except that it is equipped with a grease trap instead of urine trough.
   (3) Filter grease trap: pail or can with holes punched in the bottom and pail filled with straw. Ash barrel grease trap is also used. Barrel has 30 holes punched in bottom, 8 inches of coarse gravel or wood ashes, then 8 inches of fine sand or ashes - top covered with burlap as strainer.

(4) Baffle grease trap: half barrel or box divided into unequal chambers by a wooden baffle extending to within 1 inch of the bottom; larger section, about 2/3 of the barrel, is the influent and the smaller the effluent chamber. A strainer is placed over the influent section and the smaller, the effluent chamber, may be covered by a strainer

(5) Disposal of bath and wash water; if sewers are not available, bath and wash water is disposed of in soakage pits or trenches, and the water should pass through grease trap before it enters pit or trench.

6. Rubbish: tin cans and burned bones may be disposed of on dumps; all rubbish that can be burned should be. Tin cans and boxes must be flattened to prevent accumulation of water. Dumps should be located several hundred yards from occupied tents.

G. Fly Control

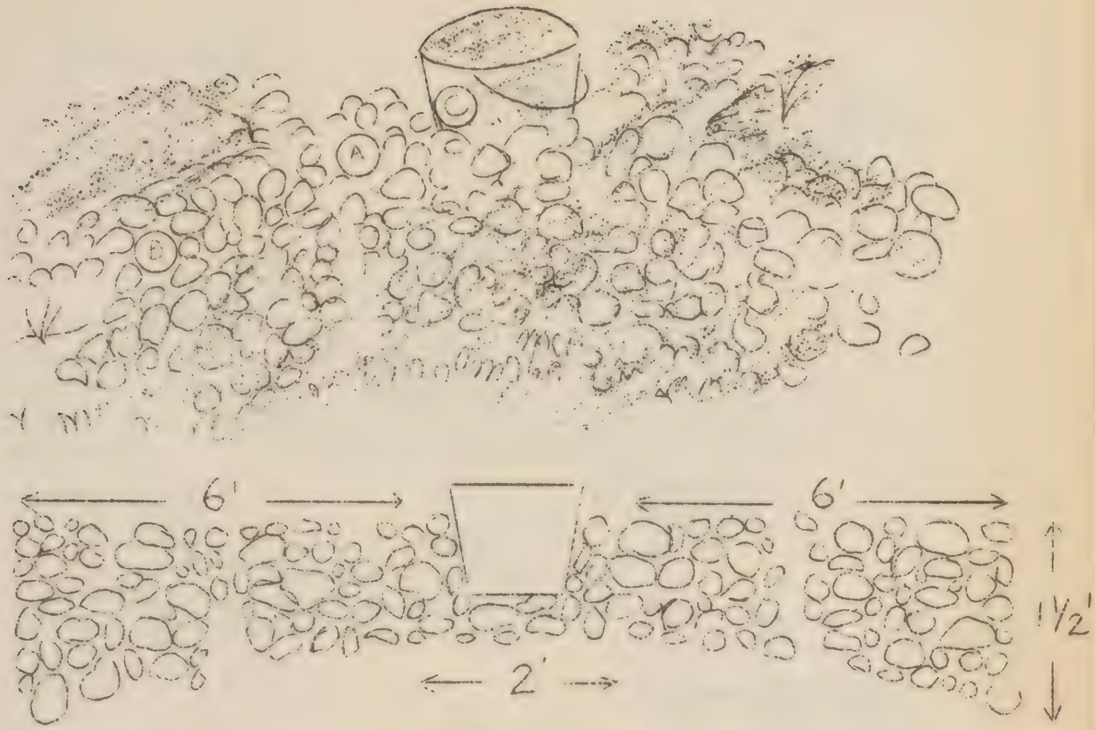
1. Flies: house fly - frequently transmits intestinal diseases, accomplished in a mechanical manner through contact with human excreta; then carries this to food or eating utensils.

   a. Life cycle of fly: in development the fly passes through four stages: egg, larva, pupa and adult. Eggs are white, oval, glistening bodies, deposited by adult female, 150 to 200, in warm, moist organic material. Example: horse manure. Egg stage, 12 hours. Larvae or maggots are then hatched which are white, wormlike creatures. They are very motile and feed on organic material, reaching maturity in 2 to 8 days; when mature, the larvae migrate to a dry cool place and pupate. Pupa - dark brown, hard outer surface. This stage lasts 2 to 8 days. Adult fly emerges from the pupal case and is ready to fly as soon as its wings harden. The female reaches sexual maturity and begins to deposit eggs in 3 to 20 days after emerging from the pupal case. Under favorable conditions, the period from the egg to adult may be as short as 1 week. Adult fly range of flight is 200 to 1000 yards.

2. Destruction of adult flies: adult flies may be destroyed by the use of fly traps, fly paper, poison sprays and swatting. These measures are temporary ones, and the elimination of breeding places and destruction of immature forms of the insect are more important.

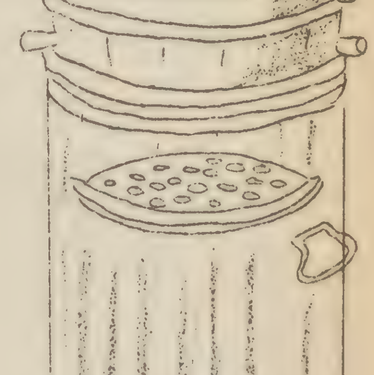
   a. Types of fly traps.

      (1) Square trap) more effective
      (2) Round trap)
      (3) Box trap
      (4) Triangular trap - more practical

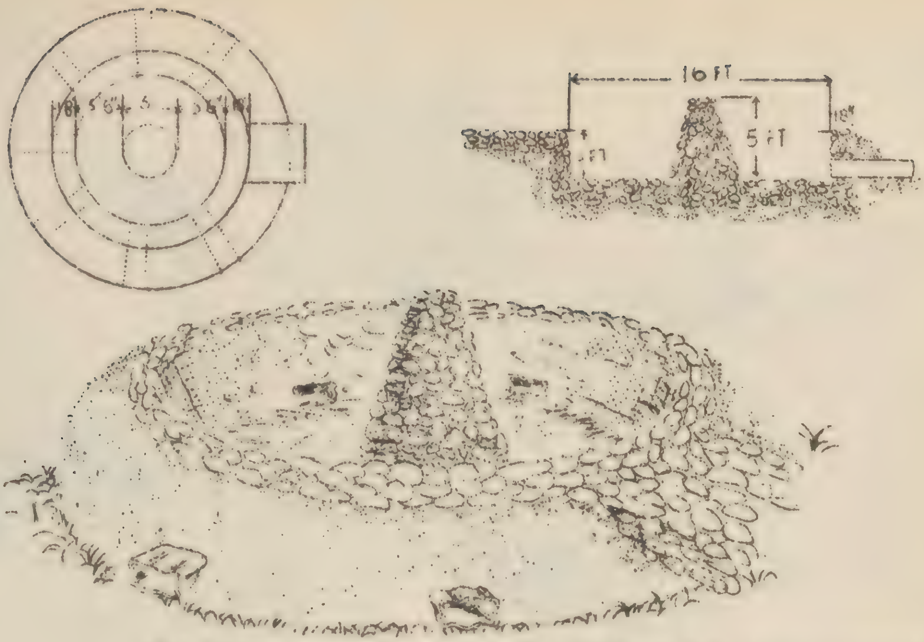


SOAKAGE TRENCH - A- Central square area; B - radiating lateral trenches; C - pail grease trap.

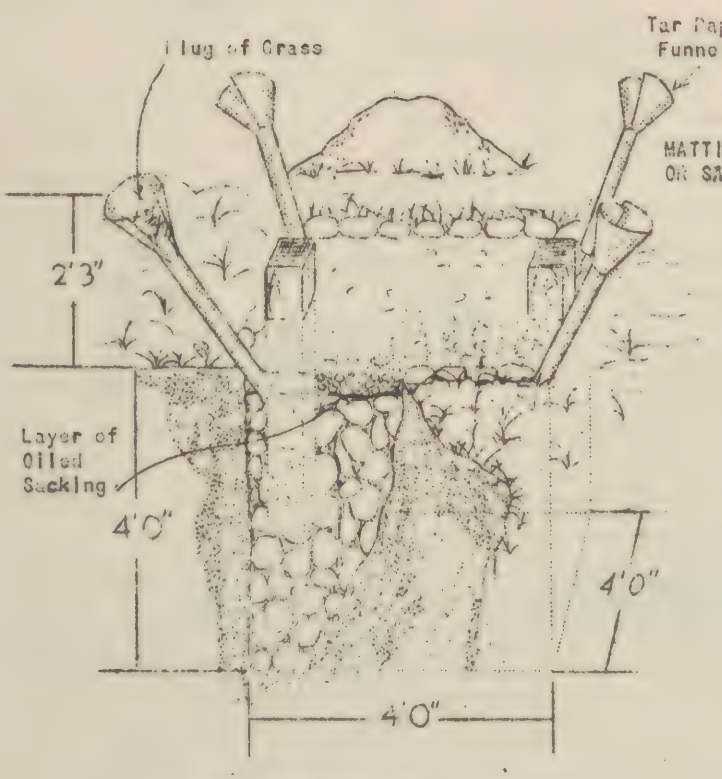
BAFFLE GREASE TRAP



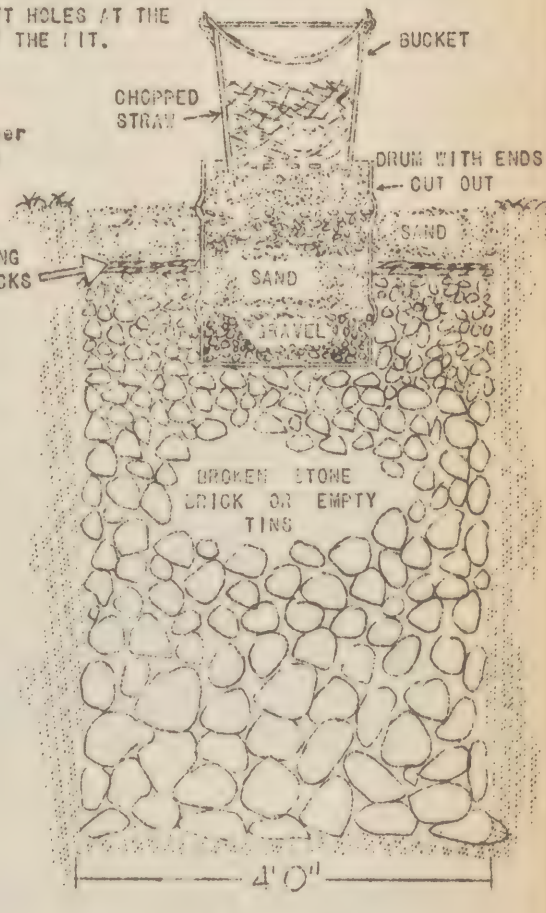
GARBAGE DRAINER



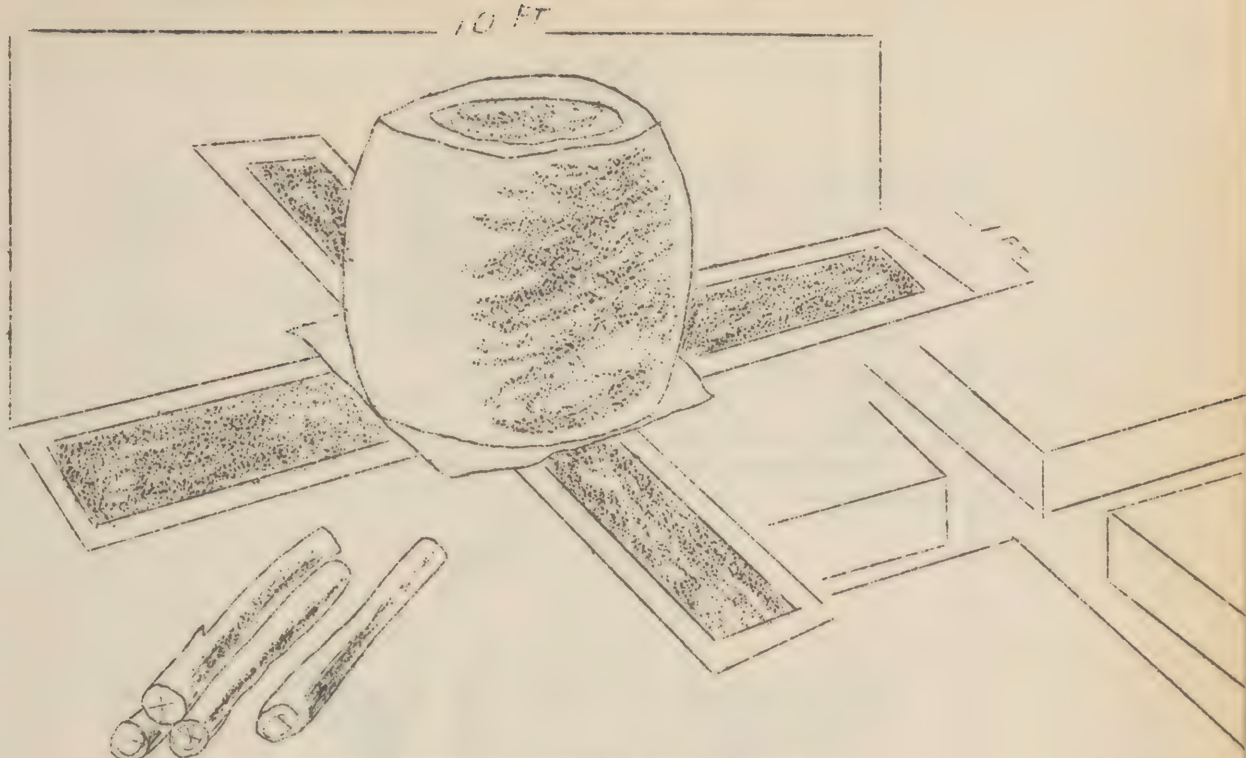
ROCK PILE INCINERATOR SHOWING DRAFT HOLES AT THE JUNCTION OF THE WALL AND BOTTOM OF THE PIT.



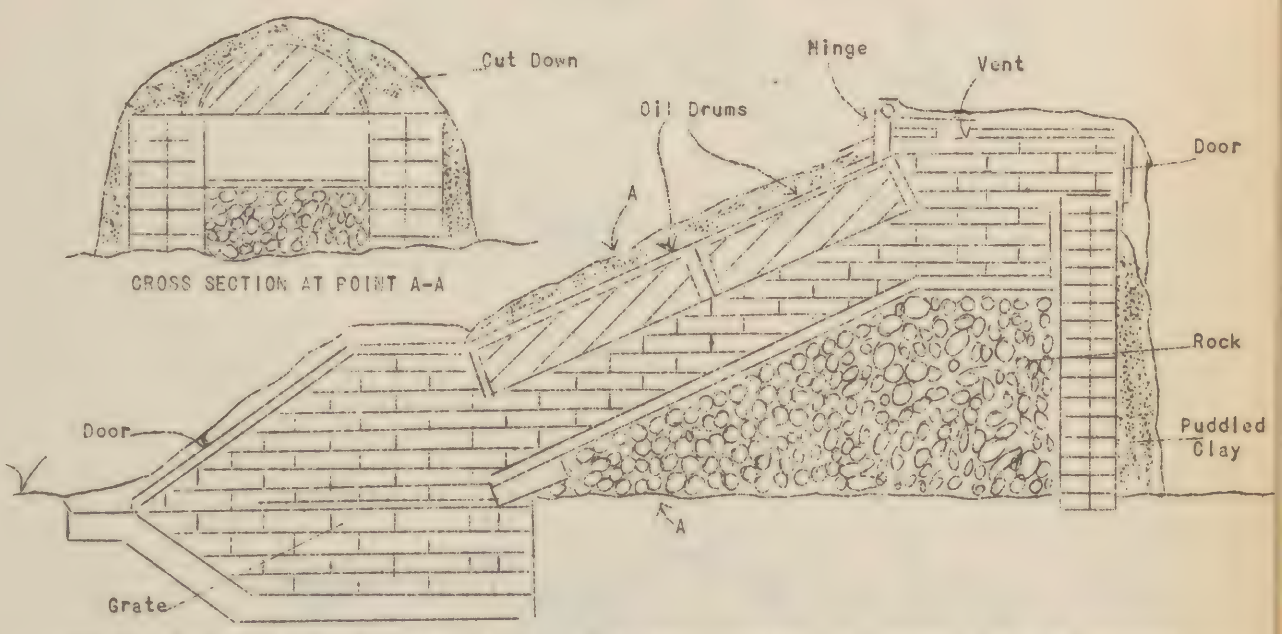
URINAL SOAKAGE PIT



KITCHEN SOAKAGE PIT

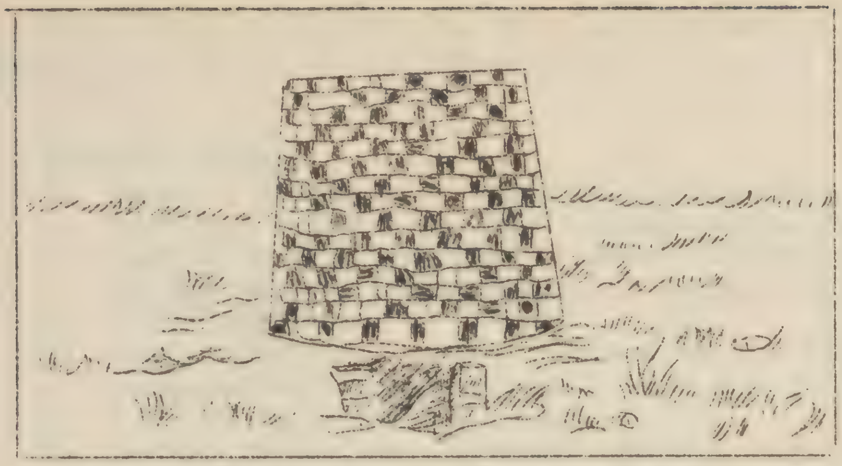


CROSS TRENCH INCINERATOR SHOWING METHOD
OF CONSTRUCTION.

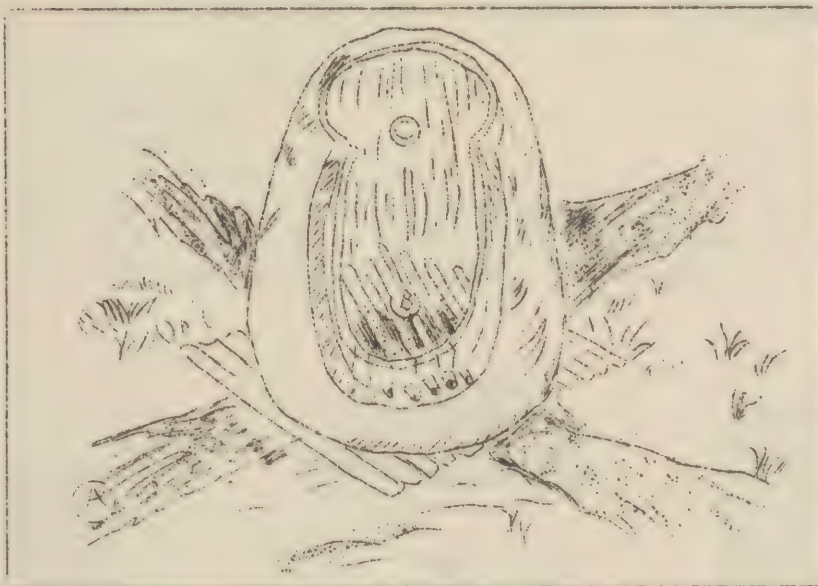


INCLINED PLANE INCINERATOR, IN LONGITUDINAL AND CROSS SECTIONS, TO INDICATE PLAN OF CONSTRUCTION.

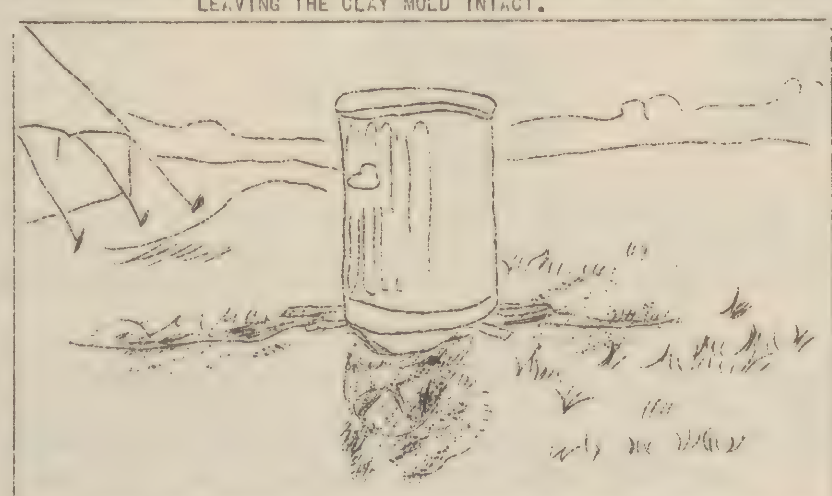
A trench is dug 11 feet, 8 inches long, 2 feet, 9 inches wide, and 1 foot, 6 inches deep, as the firebox is below the level of the ground at one end. The rock shown in the figure supports a piece of corrugated iron which is level for the first 20 inches and then slopes down to the grate.



BARREL AND TRENCH INCINERATOR WITH BARREL MADE OF BRICK



BARREL AND TRENCH GARBAGE INCINERATOR. A-FIRE TRENCHES; B-GRATE BARS; C-WOODEN BARREL, WITH SURROUNDING CLAY, WHICH IS BURNED OUT, LEAVING THE CLAY MOLD INTACT.



BARREL AND TRENCH INCINERATOR WITH BARREL MADE FROM GALVANIZED IRON GARBAGE CAN FROM WHICH THE BOTTOM HAS BEEN REMOVED.

FLY CONTROL

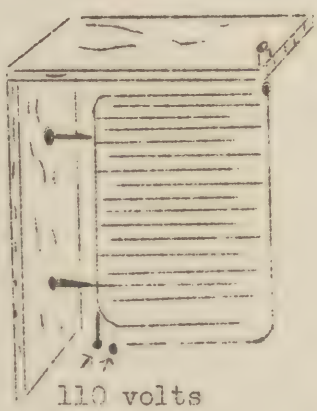
Fly control is accomplished by an understanding of the life cycle of the fly and thereby attacking one or more of its stages: the breeding, larvae or adults.

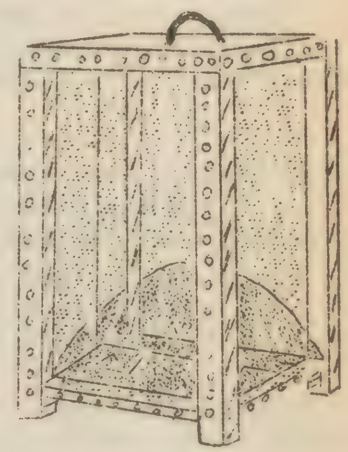
A. Breeding Places

1. Manure - dispose of by contract, incineration or compost. In permanent quarters contract or incineration may be advisable, must be carefully policed to insure complete disposal without delay. For composting of manure, see the section on Waste Disposal.
2. Human Excreta - permanent quarters require sanitary policing, permanent and semi-permanent latrine must be flyproof - see section on Waste Disposal.
3. Garbage and refuse - permanent quarters may dispose of garbage by contract incineration, but rigid policing must insure complete prompt disposal of all garbage and refuse.

B. Adult Flies - Destruction of:

1. Swatting,
2. Poisons,
3. Fly sprays, flit, etc.
4. Fly papers - many of them and fresh.
5. Fly traps - very useful, but must be used in large numbers, and policed intelligently. See below:





Place groups of traps in well-lighted positions, out of reach of strong winds, and bait them with odors that are not offensive to personnel, such as: sugar fermentations - molasses and yeast; sugar and vinegar, etc.

All fly traps require constant attention to be effective. They must be emptied and frequently cleaned, repaired and baited. Electric traps must be dismantled, cleaned and checked for short circuits. Place fly traps, giving attention to the following: Manure heaps, kitchen and mess halls, latrine, dairies, etc., dumps, incinerators, stables.

b. Fly traps should be elevated on a stand, placed near breeding places such as manure piles or latrines, or in the vicinity of mess halls, kitchens or dumps, and should be baited with bait that will attract flies but not be a nuisance.

H. Mess Sanitation.

1. Company mess is a very potent factor in the transmission of intestinal disease and to a lesser degree of respiratory infection.

2. Food handlers.

   a. Food handler examination - must be examined by medical officer before beginning duty in the mess, and each six months thereafter.

   b. Daily observation - temporary and permanent food handlers should be observed daily for communicable diseases.

   c. Cleanliness - all mess personnel wear clean clothing and have clean hands at all times; fingernails are cut short; hands are washed after visiting latrine.

3. Inspection of food.

   a. All food should be inspected for freshness and quality when received at the mess, and while in storage and before consumption. Canned foods should be inspected for leakage and gas formation within the can. Fresh meats should be inspected for slimy deposits on the surface or indications of decomposition in or near the joints or along the bones.

   b. Fresh meats, meat products, and canned foods are materials in which bacteria tend to grow rapidly and if contaminated, are dangerous to health of troops. Severe illness can result from contaminated food.

4. Storage of Food.

   a. Food supplies should be protected from insects as flies, roaches, dust and dirt, rats and mice. Perishable foods should be stored at a temperature of 55° F., or less; also in storage of foods, particularly meat, avoid packing or hanging so closely that ventilation is impaired.

   b. Temporary camps.

      (1) Food may be stored in water tight containers and immersed in springs or streams, care being taken to prevent contamination. Food may be buried below the surface of the ground where temperature is lower, lining pit with burlap and boards on the bottom.

      (2) Suspended food container: consists of a screened box that permits free circulation of air but prevents contamination by insects. The cooling effect may be increased by wrapping box with burlap which is kept damp.

(3) Underground ice box or cooling box is a simple device consisting of a double-walled box sunk in the ground with outer lid slightly above ground. The outer box is 5 feet long, 4 feet wide and 4 feet deep; inner box, 4 feet long, 3 feet wide and 3 feet deep.

(4) In semi-permanent camps, fresh or cured meats, milk and vegetables may be kept in underground storage room, similar to the old fashioned root cellar.

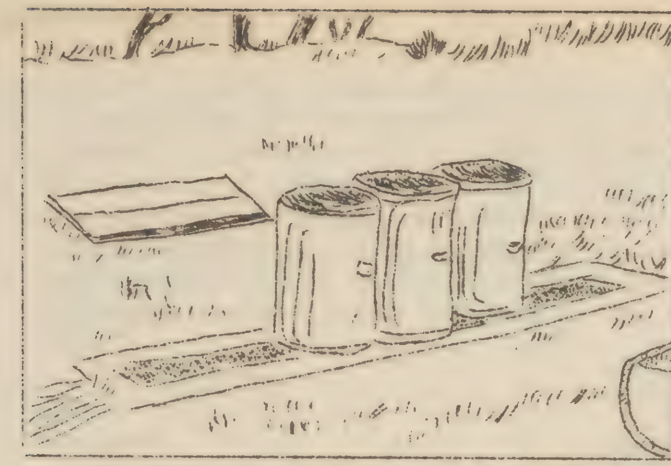
(5) Bread boxes or storage should be well ventilated, but screened to prevent access of flies to the food.

5. Preparation of food requires that the food be properly prepared and served, and a suitable variety provided. Thorough cooking and immediate serving are best safeguards against the transmission of communicable diseases by food. Bacteria will grow rapidly in many cooked foods, even when placed in an ice box. This is particularly true of meat dishes. If re-served, they should be thoroughly heated. All vegetables that are to be re-served should be thoroughly heated. All vegetables that are to be eaten raw and which cannot be peeled, should be thoroughly washed in running water before serving.

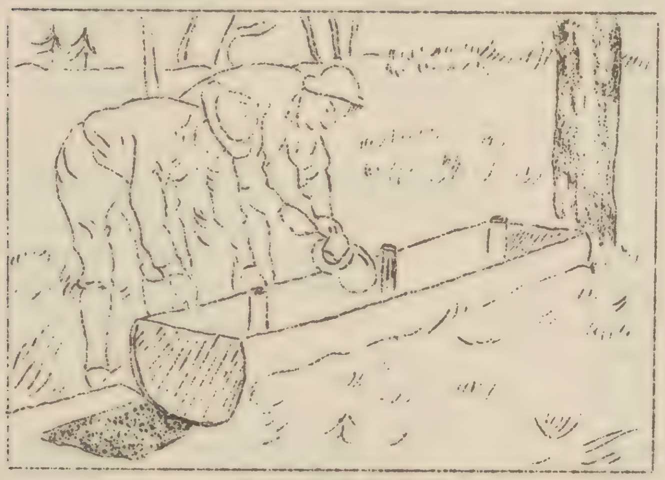
6. Care of eating and cooking utensils: all eating and cooking utensils should be sterilized immediately after use by washing in hot soapy water, then rinsing in hot, clear water, then aired and dried. Devices for washing mess kits in camps or field: (a) three G.I. cans are placed over trench 8 feet long, 1 foot wide and 1 foot deep; fire is built in trench. Two cans have soapy water, and third, hot, clean water; (b) another device is fire trench 11 feet long, 2 feet wide, 4 feet deep, with stack built at one end. Pit is filled with stones within one foot from the top. Three water containers - oil drums cut longitudinally 4 inches above center line are placed over fire box, iron pipes threaded into bung holes, and after washing mess equipment, iron pipes are removed and water escapes in soakage pit.

7. Mess tables: made so middle leaf or board is removable, to permit cleaning. Tables are scrubbed with soap and water after meals.

8. Flies: screens should be kept repaired, doors closed, flies in mess hall destroyed by traps, fly paper, sprays and swatting.



FIRE TRENCH AND CANS FOR WASHING MESS KITS.



WASHING MESS KITS.

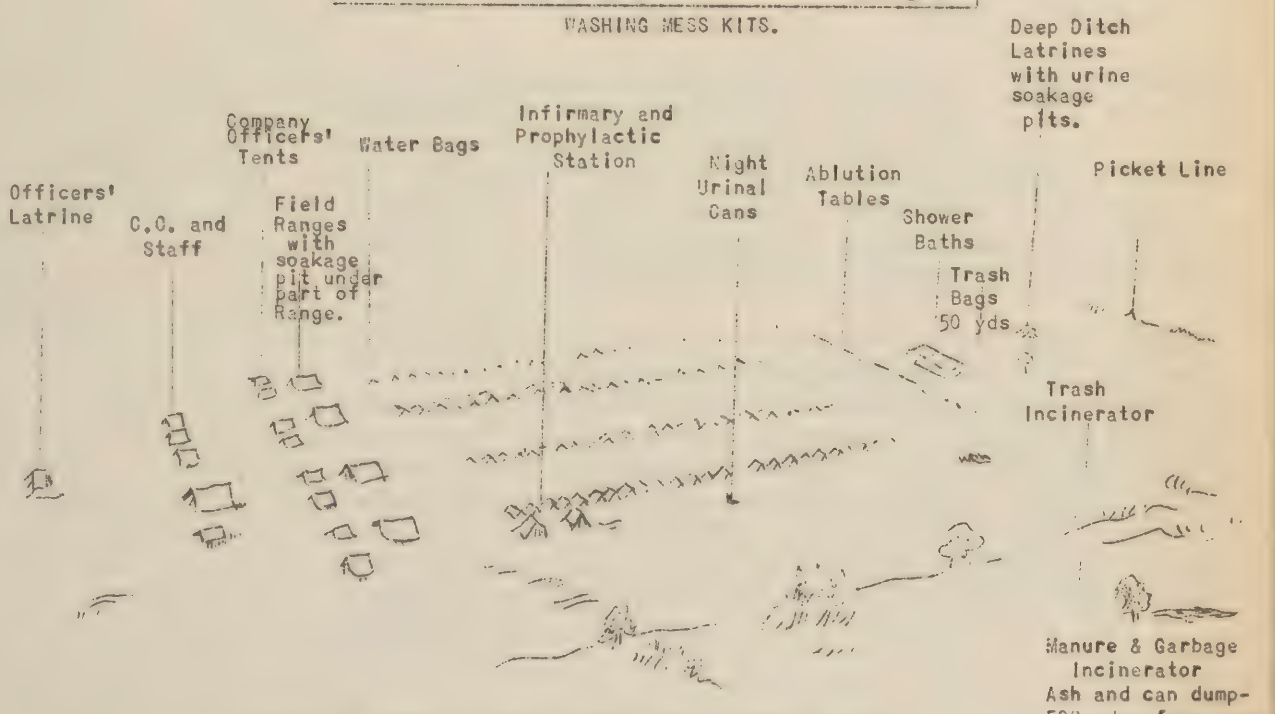


DIAGRAM OF PROPER SANITARY LAYOUT FOR A BATTALION CAMP.

V. Insect-borne Diseases

A. Definition: one in which a blood-sucking insect is the only agent by which the causal organisms are transmitted from person to person or from animal to man.

1. Tabulation of Vectors - the following tabulation of insect-borne diseases with their vectors (a vector is an insect carrier in which the disease germs undergo an essential phase of their life cycle) includes these diseases of particular interest to the Army:

Disease	Principal Vector
Malaria	Anopheles mosquito (several species)
Yellow Fever	Aedes egypti mosquito
Dengue	Aedes egypti and aedes albopictus mosquito
Tularemia	Flies, ticks, lice and fleas. (Also contact with infected material)
Rocky Mountain Spotted Fever	Ticks
Relapsing Fever	Lice and Ticks
Typhus Fever (epidemic)	Body Louse
Typhus Fever (endemic)	Fleas (usually)
Bubonic Plague	Rat flea.
Filariasis	Several varieties of mosquitos and biting flies.
Epidemic Encephalitis	Aedes and probably other mosquitos

2. The above diseases are only prevalent in regions where environmental conditions are favorable for the continued existence and maintenance of the insect.

   Where the cycle of transmission includes an animal host of the infectious agent, or of the transmitting insect, the prevalence of the disease concerned is modified or entirely absent, depending on presence of animal hosts.

3. Trench fever, Typhus fever and Relapsing fever, depend on their transmission by the human louse, which is an absolute parasite on man. Consequently, these diseases are potentially the most dangerous to military forces.

4. Transmission: depends upon the vector first sucking blood from an infected person or animal, later biting a susceptible individual. Infection may also occur from insect's saliva, or by its feces, glandular secretions or body fluids of the insect when ground into the skin by scratching.

The organisms of diseases such as Bubonic Plague may be transferred to man without undergoing any change within the body of the insect, but in others as malaria, the disease must pass through a stage of development in the body of the insect before the insect can infect another person.

5. Preventive measures to be taken against these insect-borne diseases include protecting the patient from being bitten by insects capable of transmitting the disease, and protecting healthy persons from the bites of insects which have been infected, the eradication of all insects capable of transmitting the disease and the eradication of the specific germ from the body of patients.

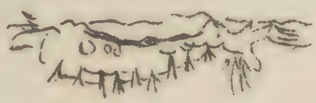
6. Control Measures for Mosquitos.
   a. Mosquito control: mosquitos not only transmit diseases as Malaria, Dengue, Yellow Fever and Filariasis, but are a source of discomfort. The most important is Malaria.
   b. Life cycle of mosquito: four stages in life cycle of the mosquito: egg, larva, pupa and the adult. The first three stages are passed in water. The adult is a free-flying insect. Males are vegetarians; females are bloodsuckers and thus act as transmitters of disease. The time necessary for egg development is about three days; larva - 10 days; and pupa - 3 days; mosquitos may breed in practically any water which persists longer than 10 days, in ponds, swamps, drains, roof gutters, tin cans, etc. Range of flight is 1 mile, more with favorable wind.
   c. Group characteristics: the three groups of mosquitos which are concerned in the transmission of disease are Anopheles, Aedes and Culex. Each of these groups contains several species whose characteristics vary somewhat. It is sufficient to the scope of this manual to list the general characteristics of the three main groups.
      (1) Anopheles
         (a) Transmits Malaria (not all species of Anopheles).
         (b) Bites at dusk, night and dawn.
         (c) Breeds chiefly in water away from habitations, preferring ponds, streams and swamps.
         (d) Eggs are boat-shaped, are laid singly, and tend to collect on the water in triangular patterns. The adult may live 1 to 3 months.
         (e) Larvae lie parallel to the surface of the water and feed at the surface.
         (f) Adults have long palpi and spotted wings and rest at an angle of 45° to the surface.

Eggs of Anopheles Mosquito.

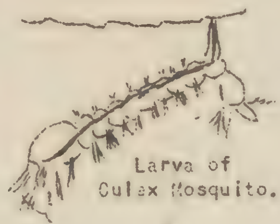
Eggs of Culex Mosquito (egg raft)

Eggs of Anopheles Mosquito showing floats.

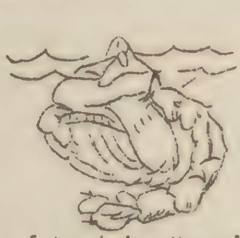
Eggs of Culex Mosquito



Larva of Anopheles Mosquito.



Larva of Culex Mosquito.



Pupa of Anopheles Mosquito

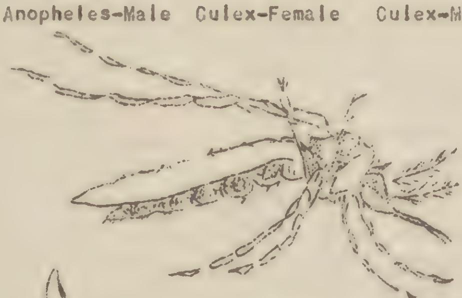
Pupa of Culex Mosquito.

Anopheles-Female

Anopheles-Male

Culex-Female

Culex-Male

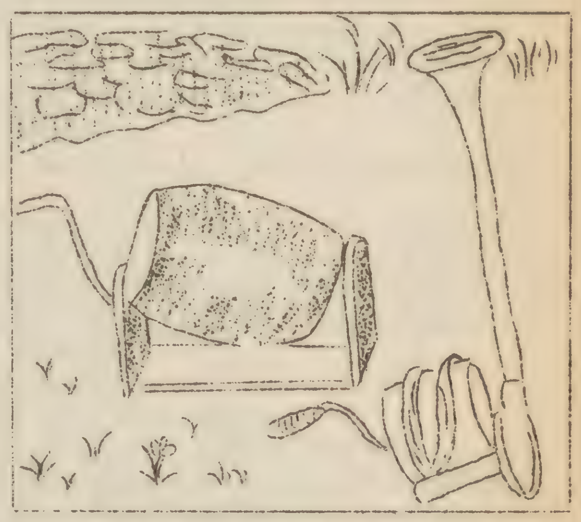


Culicini

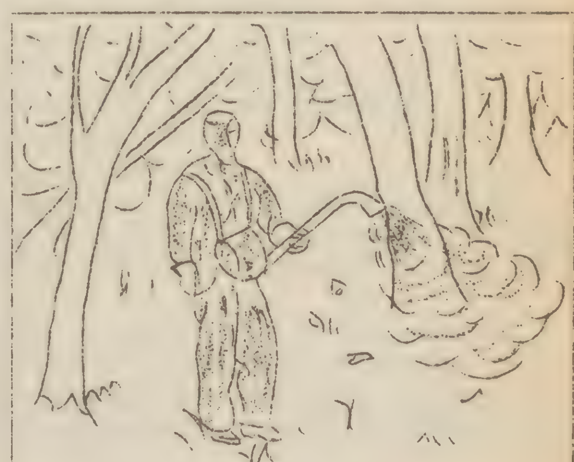
Anopheles

MOSQUITOES, RESTING POSITIONS.

KNAPSACK OIL SPRAYER



EQUIPMENT FOR MIXING AND APPLYING PARIS GREEN LARVICIDE.



METHOD OF PRODUCING DUST CLOUD OF PARIS GREEN LARVICIDE WITH HAND-OPERATED DUST BLOWER.

(2) Aedes
   (a) Transmits Dengue, Yellow Fever and Filariasis.
   (b) Bites during the day.
   (c) Breeds chiefly in collections of water in and about habitations (rain barrels, buckets, gutters).
   (d) Eggs are slender and are laid singly on water.
   (e) Larvae hang at an angle in the water, feed below the surface of the water, and breathe at the surface.
   (f) Adults have short palpi, wings clear of spots, and bodies striped with silver color. They rest parallel to the surface.

(3) Culex.
   (a) Transmits Filariasis.
   (b) Bites at dusk, night and dawn.
   (c) Breeds chiefly in and about habitations, but also in stagnant water, in swamps and cesspools.
   (d) Eggs are cemented in rafts on surface of water.
   (e) Larvae hang at an angle in the water but have longer breathing tube than Aedes.
   (f) Adults have same resting position and same short palpi as Aedes, but their bodies have no stripes.

d. Mosquito Control Measures.
   (1) Elimination of breeding places.
   (2) Destruction of mosquito larvae and adults.
   (3) Protection of man from the bites of mosquitos.
   (4) Isolation of cases and carriers to prevent infection of mosquitos.
   (5) Treatment of cases and carriers.

e. Responsibility for Mosquito Control.
   (1) Mosquito surveys are ordinarily a function of the Medical Department.
   (2) Commanding officers are responsible for the execution of mosquito control measures.

f. Elimination of Breeding Places.
   (1) Filling - this is effective. It is practical for small depressions where streams overflow or storm water collects. Earth, rocks, garbage, cinders, rubbish and old manure may be used as a fill.
   (2) Drainage - this is applicable in the case of small ponds of water or swamps, either by surface or by sub-surface drainage. Surface drainage can be accomplished by open U-shaped

ditches. These ditches may be lined with tile or cement. Unless lined, attention is required to keep out vegetation. Sub-surface drainage - either by a trench filled with small rocks or by a line of loosely joined tile under the surface of the ground.

(3) Stream training. This is effective but requires considerable labor. Stream edges should be straightened; pot holes removed; grass and underbrush removed for a distance of 4 feet both sides of stream.

(4) Emptying water containers. Containers should be emptied weekly. Frequent inspections should be made for collections of water in tin cans, gutters, or where water collects.

G. Destruction of Larvae.

1. These measures are all of a temporary nature and should be repeated every 7 to 10 days. Common larvicides are crude oil, waste motor oil, kerosene, paris green and Panama larvicide.

   a. Oiling - a continuous film of oil must be maintained on the surface of the water for 2 to 3 hours in order to kill larvae. About 1/2 pt., of oil is used to each 100 square feet of water surface. Crude oil, fuel oil, waste motor oil or various mixtures of these oils may also be used. There are various methods of applying oil.

      (1) Knapsack sprayer consists of a container for oil, a pump and a spray nozzle.
      (2) A water can - slow method.
      (3) Drip oiler may be used in slow moving streams.
      (4) Submerged oiler may be used either in streams or ponds.

   b. Paris green is mixed with 100 parts of road dust or fine ashes before application and used against adult mosquito which feeds on stream or water surface. This mixture is applied by hand, by hand blowers, or by spreading from airplane.

   c. Panama larvicide - a phenol larvicide. The volume of water to be treated must be known. It may be applied with spray or poured into the water and it will not destroy fish.

   d. Destruction by natural enemies - fish, such as the top feeding minnow eat larvae and are valuable in ponds and slow streams.

   e. Destruction of adults.

      (1) Swatting - fly swatter or folded paper.
      (2) Spraying - valuable in buildings.
      (3) Hand catching - slow and difficult, used to secure specimens.

f. Protection of Individual.
   (1) Protection from mosquitos is necessary for both patients and healthy individuals, as it controls disease and frees from discomfort.
   (2) Screening - is only of value if maintained in perfect repair.
   (3) Mosquito nets. Mosquito nets or bars are to be used on beds in all areas where mosquito-borne diseases are endemic.
   (4) Repellents. These are mixtures which when applied to the skin partially or completely repel mosquitos. Use 1 part of epsom salts, 10 parts water; oil of citronella and camphor and oil of cedar wood.

g. Medicinal prophylaxis - quinine or atabrine are valuable means of preventing the development of Malaria among troops in areas where Malaria is highly prevalent and where satisfactory protection from mosquitos cannot be secured. Dose of quinine should be 5 to 10 grains each day.

7. Control of Lice
   a. Diseases transmitted. Lice transmit typhus fever, trench fever and relapsing fever.
   b. Classification of lice.
      (1) Pediculus humanus corporis ("body louse", "cootee"). This one is chiefly responsible for transmission of louse-borne diseases.
      (2) Pediculus humanus capitis - head louse.
      (3) Phthirius pubis (crab louse)
   c. Life Cycle
      (1) Egg stage - eggs are attached to the hairs of the body and head, fibers of clothing by cement excreted by the female. They are opaque, yellowish, ovoid in shape and pin point in size. Egg hatches in about 8 days at temperature of 86° to 90° F.
      (2) Larval stage - larvae are whitish in color and pin head in size. This stage lasts about 9 days.
      (3) Adult stages - adult female, starts to lay eggs within a day after development; 5 to 10 per day for 30 days.
   d. Characteristics of Lice.
      (1) All three types must live on human blood for existence and will die if deprived of it. In higher temperature more food is required and they die more quickly if food is not available.
      (2) Lice are disseminated by adult lice or eggs being dropped off the body in straw, debris, blankets, clothing or on latrine seats; crab lice by sexual contact.

(3) Lice and eggs are killed in 5 minutes by dry heat of 131° F. and 1 minute by 155° F.; killed in 30 seconds by boiling water.
(4) Lice do not transmit disease by act of biting. They defecate as they feed. The disease viruses are in the excreta and are scratched into the skin by the human host.

e. Delousing - must be universally effective throughout unit.
(1) All individuals must bathe thoroughly and shave various parts of body if necessary.
(2) Clothing and equipment must be deloused.
(3) Latrines, beds and any objects possibly harboring lice must be disinfected or destroyed.
(4) Clean clothing must be issued to all individuals.

f. Bathing.
(1) Improvised shower bath.
(a) A water sterilizing bag is suspended from a scaffold on a tree limb. Stone filled soakage pit constructed beneath shower.
(2) Large tin can with perforated bottom may be suspended from a tree and platform - one man pours water in the can while another bathes.
(3) Barrel with valve in the bottom may be used. This is made by a plunger which fits in a can and is controlled by means of a lever and handle within the reach of bather.

g. Shaving is necessary when eggs are present on hairs, as eggs are difficult to remove.

h. Sprays are not advisable.

i. Head lice - if head lice are present, loosen the eggs from the hair by the thorough application of vinegar followed by shampooing the scalp with hot soapy water containing 25% of kerosene; hair should be combed with a fine toothed comb to remove nits not removed by washing; when possible the hair should be clipped short.

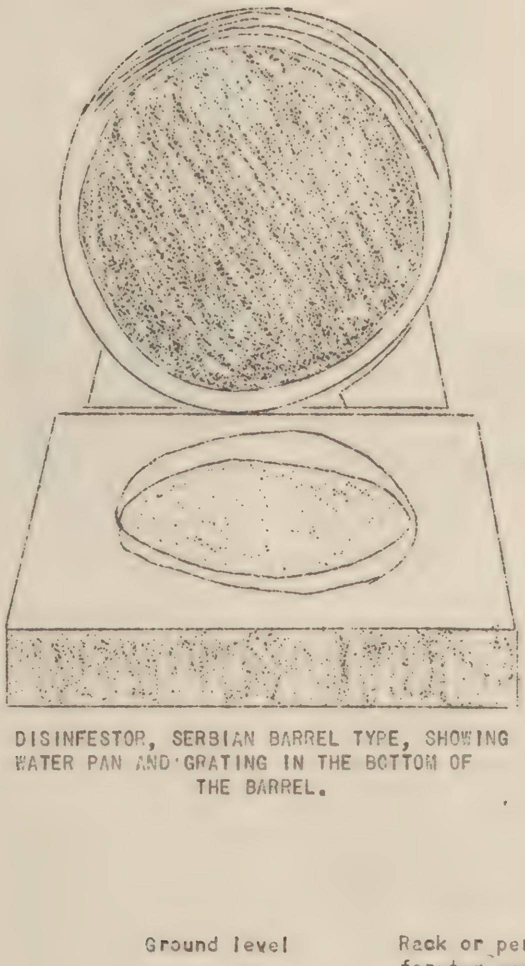
j. Disinfestation of clothing and equipment.
(1) Steam will not seriously affect cotton or woolen cloth, but will damage leather, felt or webbing. Boiling water will shrink woolen cloth. Dry heat is practically harmless for all articles except wool, which it will damage somewhat.
(2) Available methods for delousing:
(a) Mobile disinfestor (Q.M. function) four-wheeled trailer type and are usually steam pressure disinfestors. After clothing is placed in the disinfestor, a vacuum of 10 to 15 inches is created, then steam is turned into the inner chamber until a

Adult Wood Tick

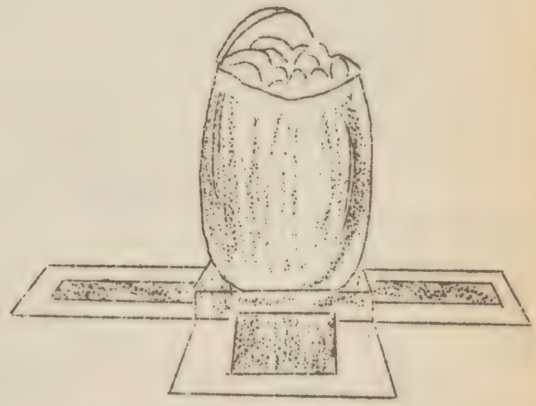
Body Louse

Crab Louse

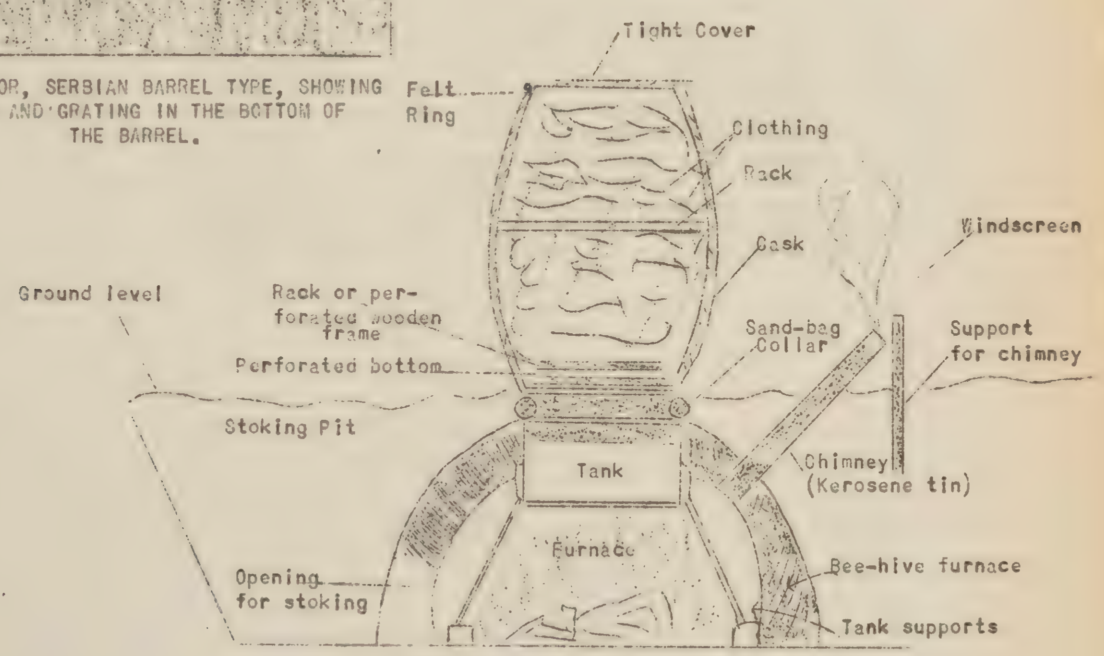
Bed Bug



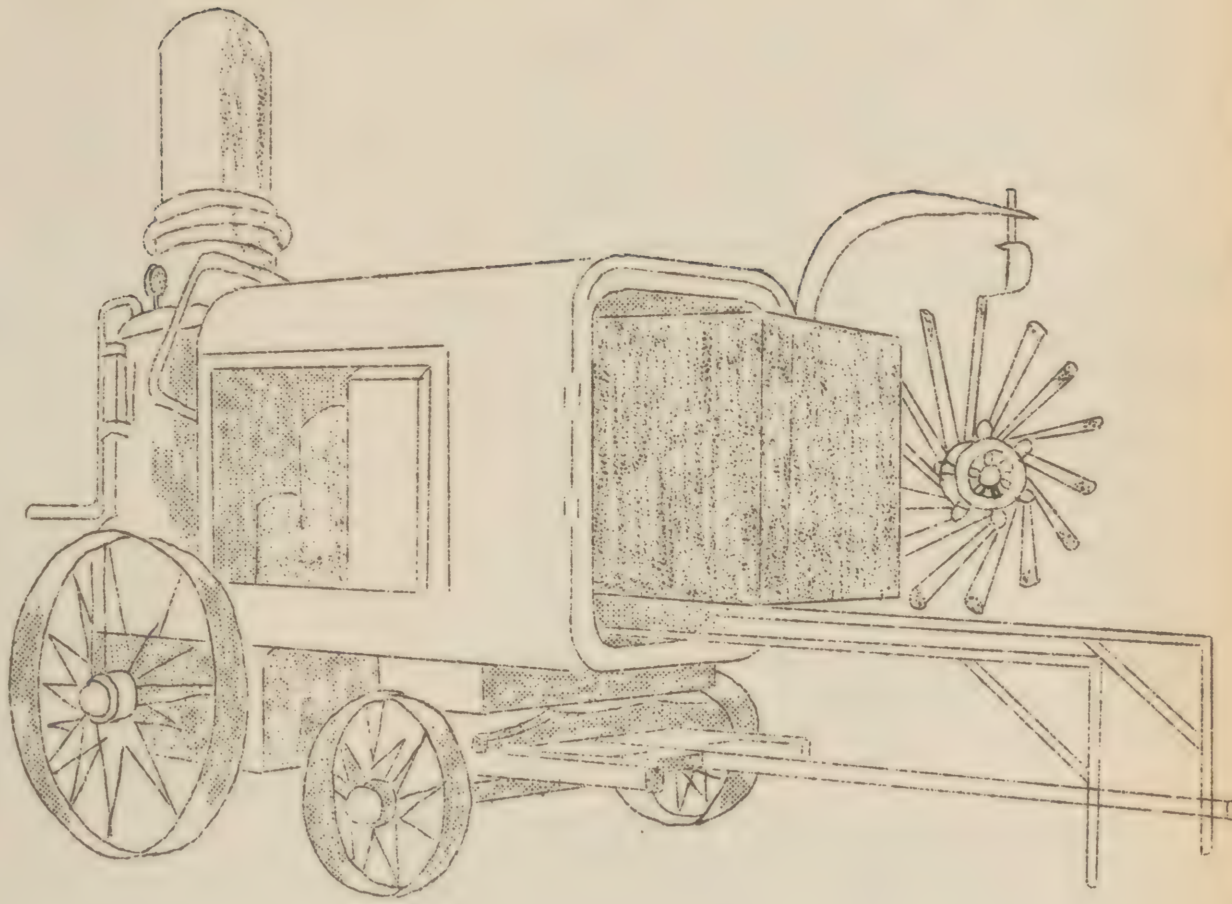
DISINFESTOR, SERBIAN BARREL TYPE, SHOWING WATER PAN AND GRATING IN THE BOTTOM OF THE BARREL.



DISINFESTOR, SERBIAN BARREL TYPE



THE SERBIAN BARREL FOR DISINFESTATION OF CLOTHING.



MOBILE DISINFESTORS - - These are of the four-wheel trailer type and are usually steam pressure disinfestors although a current steam disinfestor is manufactured (thresh type). The pressure type consists of a horizontal steam chamber around which there is an outer jacket which is assembled as a unit with a boiler. After the clothing is placed in the disinfestor, a vacuum of 10 to 15 inches is created after which steam is turned in until a positive pressure of 15 pounds is attained, this being held for about 20 minutes. At the end of this time the steam is released and a vacuum of 10 to 15 is produced in order to dry the clothing. This vacuum is held for about 5 minutes. Clothing should be placed in loosely in order that the steam may penetrate.

positive pressure of 15 pounds is obtained. Pressure is held for 20 minutes, steam released and a vacuum of 10 to 15 inches is held 5 minutes to dry the clothing.

(b) Serbian Barrel Type - this is a company installation and consists of a barrel in which the clothes are placed to be disinfected. The lower part contains a receptacle for water which is placed on an improvised firebox.

(c) G.I. can is usually most practicable, for no separate container for water is necessary.

(d) Clothing and equipment may be placed in ovens, boxes and cans which are subjected to dry heat. After removing as many lice as it is possible by hand, clothes are pressed with a flat iron. Where practicable, clothing made of cotton, linen, and silk, may be boiled for five minutes. Leather belts, shoes and hats which cannot be disinfested by other means, should be immersed in a 5% cresol solution for 30 minutes.

(e) Storage of infested clothing and equipment will accomplish disinfestation by depriving the lice of a food supply. Store in a dry place 30 days.

8. Control of Ticks

a. Diseases transmitted - ticks are able to transmit the causal agents of Rocky Mountain Spotted Fever, Relapsing Fever, Tularemia, through the egg stage to the progeny, any stage of which is capable of inoculating the host with the causative agent.

b. Habits and characteristics - life cycle of tick consists of egg, larvae, nymph and adult. Tick deposits several thousand eggs on the ground. Egg stage is 3 to 4 weeks. Larvae seek a warm-blooded host upon which they feed for 2 to 4 days, drop to ground, remain dormant for several weeks. They molt and become nymphs which again seek a warm-blooded animal upon which to feed for 4 to 8 days. Nymph then drops to the ground; after several weeks, molting occurs and adult emerges. Adult finds a host and attaches itself. Adult ticks can live 2 years without food and cold weather will not kill them.

c. Control measures - control of tick-borne diseases by ridding the country of ticks is difficult. Buildings of little value infested with ticks, should be burned or kerosene or cresol insecticide may be used. Control of the tick is mainly through control of wild animal hosts and eradication of smaller animals in tick infested country or area is desirable.

d. All individuals in tick infested localities should frequently examine their exposed skin area and promptly remove the ticks.

9. Control of Bedbugs

a. Bedbugs exist where they can live in close association with man; they have been suspected of transmitting relapsing fever and leishmaniosis. However, since they are blood-sucking insects they may transmit any disease in which there is a blood stream infection.

b. Habits and Characteristics - life cycle of bedbugs consists of egg, larvae and adult stages. Eggs are deposited in cracks and crevices and hatch in 4 to 10 days in warm weather; larvae are yellowish white and resemble adults; blood is necessary for the development of the larvae and they are developed to adult stage in 6 to 11 weeks. Bedbugs feed at night and may survive 6 months or longer without food. All forms killed at a temperature of 113° F, or temperature below freezing. Bedbugs are spread by clothing, bedding, baggage or furniture. They hide in any crevice of wooden or metal structure.

c. Control Measures

(1) Fumigation - this is the most effective way to destroy bedbugs, provided a penetrating gas is used, such as, hydrocyanic acid gas; however, this gas is dangerous. Sulfur may be used for fumigation. Fumigation should not be attempted by untrained personnel.

(2) Liquid insecticides are effective if thoroughly and repeatedly used. An effective mixture is kerosene containing 10% cresol or 5% turpentine. Kerosene alone can be used; steam may be used for cloth and beddings; dry cleaning and hot water; hand picking, brushing and shaking, also flaming the steel cots with blow torch is effective.

10. Control of Roaches and Ants.

a. Roaches and ants do not transmit any insect-borne disease, but may transmit intestinal diseases by contamination of food.

b. Control Measures

(1) Deprive ants and roaches of food supply by cleanliness of mess and by protection of food supplies through refrigerators and screened cabinets.

(2) Sodium fluoride placed in cracks and crevices or spraying with liquid insecticide are efficient. This is best done at night.

(3) Ants are destroyed by destruction of nest; by use of boiling water or kerosene.

11. Control of Fleas

a. Several varieties of fleas are vectors of Bubonic Plague and Endemic Typhus Fever. Various small animals, particularly rodents serve as reservoirs of infection from which fleas may transmit Bubonic Plague or Endemic Typhus Fever to man. The rat flea is the most common vector. Fleas sometimes select man as host when he comes in direct contact with small animal hosts.

b. Control Measures.

(1) Elimination of Animal Hosts

(a) Pet animals as cats and dogs may be freed of fleas by washing in 10% emulsion of kerosene.

(b) Rats - are a reservoir of infection of Bubonic Plague and Typhus Fever and also a factor in spread of other diseases. Rats are destroyed by trapping and poisoning, fumigation, use of natural enemies and rat-proof buildings.

(2) Destruction of fleas is accomplished by

(a) Fumigation as for bedbugs.

(b) Spraying and scrubbing - fleas are destroyed by scrubbing with soapy water containing 10% kerosene and 5% cresol.

VI. Miscellaneous Diseases

These diseases include Scabies, Smallpox, Chickenpox, Tetanus, Rabies, Gas Gangrene, Ringworm and Plant Dermatitis.

Scabies - is a skin disease produced by the action of certain small animal parasites commonly called "itch mites". The parasites are transferred from one patient to another through contact. To prevent Scabies, cleanliness is essential and those infested should be isolated, have their skin treated and their clothing, bedding, etc., disinfested.

Smallpox - the specific organism which is unknown, is probably transmitted from one person to another by direct contact, and by contact with articles soiled with the discharges of infected individuals, and perhaps by flies. Preventive measures against Smallpox include prophylactic vaccination of all individuals; and isolation of the patient until all lesions are completely healed.

Chickenpox - a mild disease, is probably transmitted in the same manner as Smallpox, and resembles slight cases of the latter. Patients suffering from Chickenpox should be isolated until the lesions are completely healed.

Tetanus - or lockjaw, is caused by the tetanus bacillus, which ordinarily gains access to the human body through a wound. Preventive measures against lockjaw include personal cleanliness; the prompt treatment of all wounds, particularly gunshot and punctured wounds, and the administration of tetanus antitoxin. Because the soil of a battlefield, especially in cultivated areas is contaminated with the tetanus bacillus, regulations require that all men wounded in action be given 1500 units of tetanus antitoxin, and that the fact of its administration be entered on the emergency medical tag, field medical card, etc. Subsequent doses are given, if necessary. Patients with any other kind of wounds, suspected of being infected with the tetanus bacillus, are given similar prophylactic doses of anti-tetanic serum.

Rabies, or hydrophobia, is transmitted from the lower animals, usually the dog, to man by the injection of the saliva into wounds which have been produced by bites of the rabid animal. In man, about forty days elapse between the time of being bitten and the development of the disease. Fortunately, this long incubation period affords ample opportunity for the administration of anti-rabic vaccine, more commonly known as the Pasteur Treatment, a method of prophylaxis against the development of the disease which has proven highly satisfactory.

In addition to the vaccine, other preventive measures include muzzling and leashing of all dogs, and carefully observing and examining the animal suspected of having Rabies. When a clinical diagnosis of Rabies in the animal is confirmed, he is killed and his brain is examined for specific evidence of the disease. As a matter of routine, all bites produced by animals should be thoroughly cauterized with nitric acid and otherwise surgically treated.

There is now commercially available an anti-rabic vaccine, which, if administered universally and annually to dogs as a prophylactic measure, would go far towards eradicating this dreaded disease. This treatment does no harm to the dog.

Gas Gangrene is an acute infection, occurring in large macerated wounds contaminated with human or animal waste found in soil. The infection is associated with compound fractures and large crushing or tearing wounds that come in contact with the soil, but it has occasionally followed puncture wounds or small abrasions. Once the disease develops it is extremely difficult to control. The mortality is very high.

Prevention - every extensive wound should receive the best of attention, the patient being placed in a hospital.

Treatment - in mild cases, the wound should be cleansed of all discolored, frayed or devitalized muscle or skin tissue. It may be necessary to sacrifice entire muscles. The wound should be left open. Irrigation and cleaning of the wound should be frequent. In advanced cases, extensive excision or amputation may be necessary.

Anti-toxic sera should be used as a prophylactic in all wounds where contamination with gas bacilli is probable.

Ringworm - the terms "trichophytosis" or ringworm compose a group of skin infections due to parasitic fungi. Numerous different fungi may be responsible for these infections and all parts of the human body may be involved, i.e., Tinea Cruris or Dhobie itch which is ringworm of the inguinal region, or groins. Tinea Circinata is ringworm of the body. Dermatophytosis (athlete's foot) is ringworm of hands and feet. All of these infections tend to become chronic, and all thrive in warm weather or in other conditions which result in perspiration. They are common in all walks of life. They may be mild or severe and disabling.

Control Measures for all forms of ringworm infection are the same. The main object is to prevent the bare skins of noninfected individuals from coming in contact with any objects which may have been contaminated by infected persons.

Treatment - All cases should be promptly and adequately treated; self-treatment will often aggravate the condition. Proper care of the feet is important in the prevention and control of ringworm of the feet. All bathhouses should be equipped with foot baths, containing solution to prevent this infection; however, the most effective control measure is disinfection of bathhouses, floors and equipment and by the disinfection of towels, swimming or gymnasium equipment. Disinfection by boiling, by solutions of calcium hypochlorite, 1 oz. to 1 gal. of water; 2% cresol solution may be used. Shoes are treated by 1% thymol in gasoline or alcohol.

Plant Dermatitis - (Poison ivy, poison oak, poison sumac). These are the common plants that produce skin irritation in susceptible persons. Harmful part of the plant is the resinous sap or oil which exudes from all injured surfaces. The symptoms which appear within 24 hours after contact, are generally severe intense, burning and itching and a feeling of increased tension of the skin.

Control Measures

1. Learn to recognize the plant and then avoid it.
2. Wear gloves while at work.
3. Change outer clothing and gloves before associating with other men.
4. Burn poisonous plants away from camp and so the wind is blowing smoke away from camp.
5. Choose camp sites where poisonous plants are not present.

Personal Measures - contaminated clothing and implements should be well washed with water (soda water, if possible) or exposed to direct rays of the sun for several hours.

All parts of the body that have been exposed to the plants should be well washed with a strong soap solution or alcohol, gasoline or kerosene may be used. Washing must be prompt or poisons will spread.

If blisters appear, see a medical officer and receive medical treatment.

INFORMATION RELATIVE TO COMMUNICABLE DISEASES

DISEASE	INFECTIVE AGENT	SOURCE	TRANSMISSION AVENUE OF	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE
Measles	Filtrable Virus	Discharges of mouth and nose	Contact: direct indirect	10 days	a.2 weeks after onset. b.2 weeks after cessation of symptoms in last case.
Mumps	Filtrable Virus	Discharges of mouth	Contact: direct indirect	12 to 26 days, usually 18.	a.While swelling lasts. b.None.
Diphtheria	Diphtheria bacillus	Discharges of nose and throat	Contact: direct indirect Food: milk milk products	2 to 5 days	a.Until cultures are avirulent. b.Until cultures are avirulent
Scarlet Fever	Streptococcus Scarlatinae	Discharges of nose, throat, ears, abscesses, wounds	Contact: direct indirect Food: milk milk products	2 to 7 days, usually 4.	a.28 days from onset. b.7 days from last exposure
Septic Sore Throat	Streptococcus Epidemicus	Discharges of throat and nose. Udder of infected cow.	Contact: direct indirect Food: milk milk products	1 to 3 days.	a.Course of disease. b.7 days
Influenza	Undetermined	Discharges of throat, mouth and nose	Contact: direct indirect	24 to 72 hours	a.Acute stage. b.None

*Note: a. Isolation of patient; b. Quarantine of contacts.

INFORMATION RELATIVE TO COMMUNICABLE DISEASES

DISEASE	INFECTIVE AGENT	SOURCE	TRANSMISSION AVENUE OF	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE
Common Respiratory Disease. (Colds, sinusitis, laryngitis, bronchitis, etc.)	Viruses, Streptococcus and others.	Discharge of Nose and Throat	Contact: direct indirect Food: milk milk products	1 to 3 days	a. Duration of disease b. None
Whooping Cough	B. pertussis	Discharges of Nose and Throat	Contact: direct indirect	10 days	a. Duration of disease. b. 12 days.
Pneumonia	Pneumococcus, Streptococcus and others	Discharges of Nose and Throat.	Contact: direct indirect	1 to 5 days	a. Course of disease b. None
Pulmonary T.B.	Koch's bacillus	Discharges of Nose and Throat	Contact: direct indirect Food: milk and meats	Several weeks to several months	a. Active cases b. None
Tularemia, Psittacosis, Bubonic Plague	Bacillus Tularense, Rickettsiae, B. Pestis	Normally the bite of blood-sucking insects, but occasionally the discharges of nose and throat.	Blood sucking insects, sometimes the direct and indirect with pulmonary types of these cases.	1 to 5 days	a. Duration of diseases b. 7 days.
Meningococcic Meningitis	Diplococcus intracellularis meningitis	Discharges of mouth and nose	Contact: direct indirect	2 to 10 days, usually 7.	a. 14 days after onset b. 14 days

INFORMATION RELATIVE TO COMMUNICABLE DISEASES

DISEASE	INFECTIVE AGENT	SOURCE	TRANSMISSION AVENUE OF	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE
Poliomyelitis (Infantile paralysis)	Undetermined, probably filtrable virus.	Discharges of nose, throat and bowels.	Contact: direct indirect Food: milk	Uncertain, probably 3 to 10 days, usually 6 days.	a. 3 weeks from onset. b. 14 days from last exposure.
Typhoid Fever	Typhoid bacillus	Bowel discharge and urine	Water Food Contact: direct	7 to 23 days, usually 10 to 14	a. Until 2 successive stool cultures are negative. b. None.
Dysentery Bacillary	Flexner-Y bacillus, Shiga-Kruse bacillus.	Bowel discharge	Water Food Contact: direct indirect	2 to 7 days	a. 2-6 weeks after recovery. b. None
Dysentery Amebic	Endamoeba Histolytica	Bowel discharges	Water Food Contact: direct indirect	20 to 95 days	a. Prove patient is no longer a carrier. b. None.
Dengue	Filtrable virus	Blood of man	Bite of infected mosquito. Aedes Egypti	4 to 5 days.	a. During course of disease. b. None.

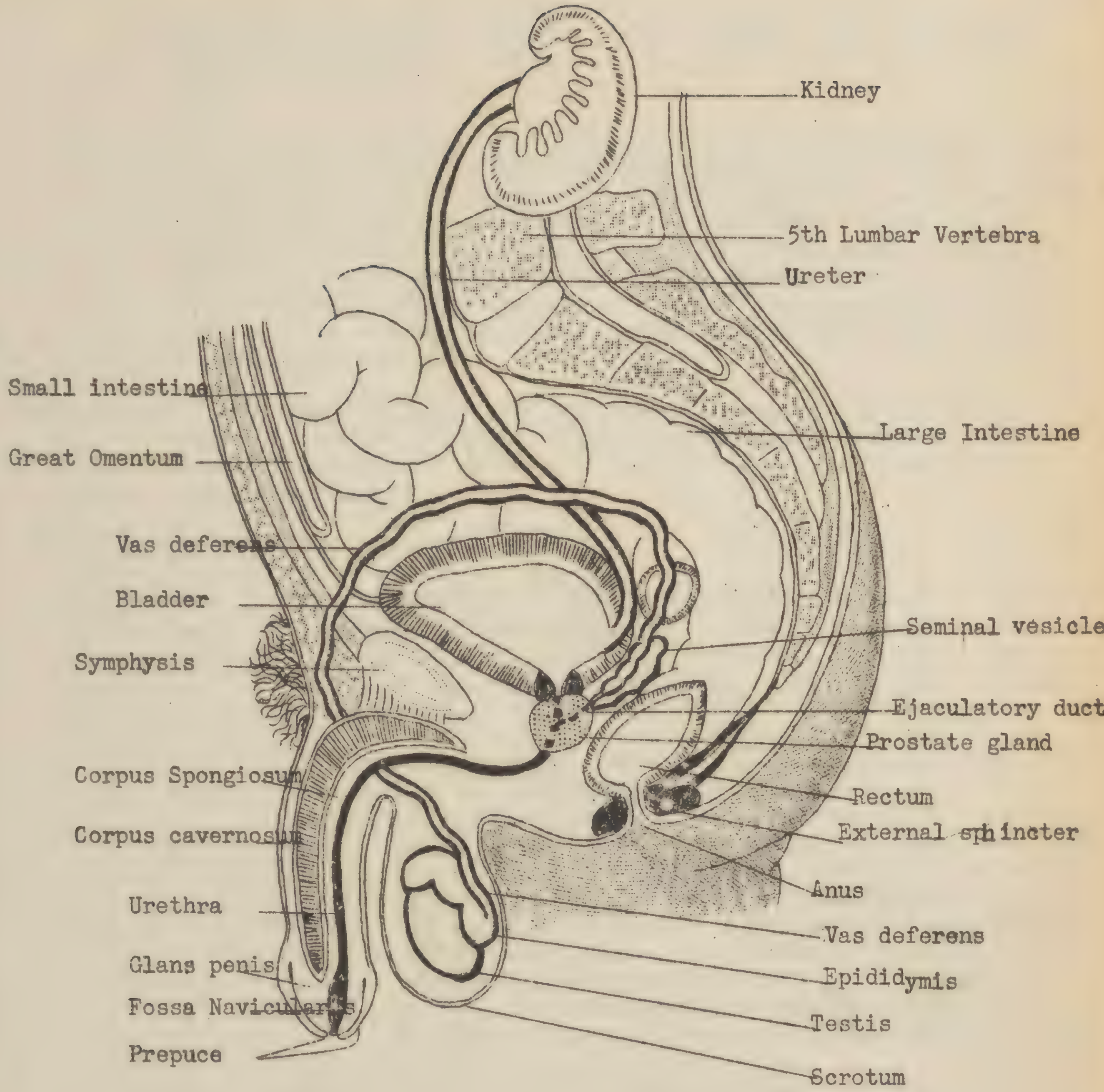
INFORMATION RELATIVE TO COMMUNICABLE DISEASES

DISEASE	INFECTIVE AGENT	SOURCE	TRANSMISSION AVENUE OF	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE
Malaria, 3 types: tertian, quartan, aestivo-autumnal	Plasmodium malariae, 3 types	Blood of man	Bite of infected mosquito. Anopheles	Varies: usually 14 days in tertian type	a. During duration of disease. b. None.
Plague, 2 types: Bubonic, Pneumonic	Bacillus pestis	Blood of man & rodents: rats commonly	Bite of infected rat flea. Accidental, by bites of infected animals; bedbugs, flies Contact: direct.	3 to 14 days	a. During course of disease. b. 7 days.
Typhus Fever, Epidemic	Rickettsia, Prowazeki	Blood	Infected lice	5 to 20 days, usually 12.	a. During course of disease. b. 2 weeks.
Relapsing Fever	Spirochetes, several varieties	Blood	Infected lice and ticks. Contact: direct.	3 to 12 days, usually 5 to 7.	a. During course of disease. b. 2 weeks.
Rocky Mountain Spotted Fever	Probably Rickettsia	Blood of infected animals and infected ticks.	Infected ticks and mites.	3 to 10 days, usually 7.	a. During course of disease. b. None.
Tularemia (Rabbit Fever)	Bacterium tularense	Wild rabbits, chipmunks, ground squirrels and quail. Flies, ticks.	Infected flies and ticks. Contact: direct.	24 hours to 9 days, usually 3.	a. During course of disease. b. None.

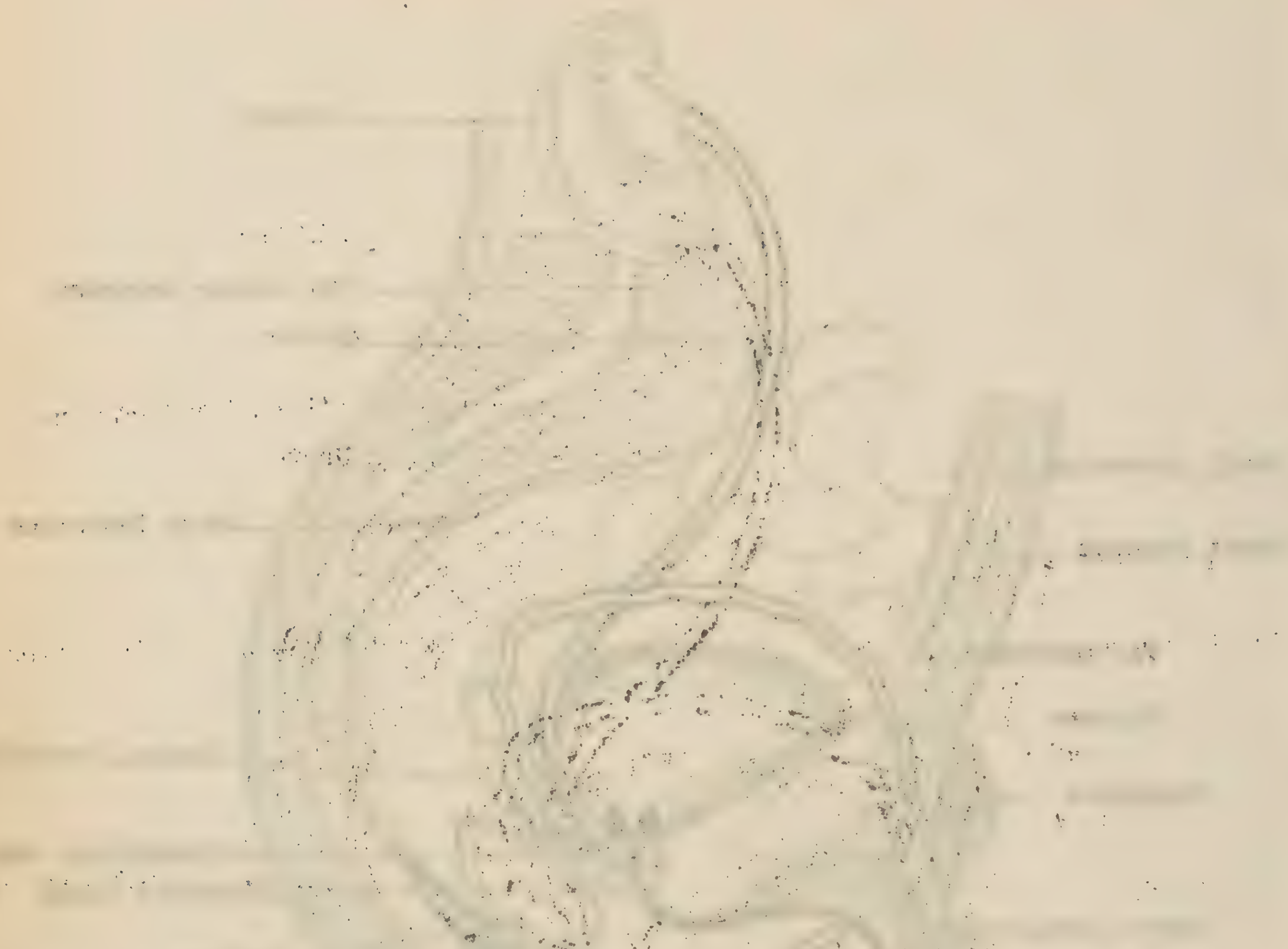
INFORMATION RELATIVE TO COMMUNICABLE DISEASES

DISEASE	INFECTIVE AGENT	SOURCE	TRANSMISSION AVENUE OF	INCUBATION PERIOD	*a. ISOLATION b. QUARANTINE
Undulant Fever	Brucella Melitensis	Milk of cow and goat. Bowel discharges and urine: cow, goat, hog.	Food. Milk. Contact: direct	6 to 16 days.	a. During period of communicability. b. None.
Tetanus (Lockjaw)	Tetanus Bacillus	Animal manure. Soil - Street dust.	Inoculation Wound Infection.	4 days to 3 weeks.	a. None b. None.

SOCIAL HYGIENE



SAGITTAL SECTION OF THE LOWER PART OF THE MALE TRUNK



SOCIAL HYGIENE

The chief ultimate desire of the average normal man and woman is to marry and have a healthy family of their own. This possibility can be readily destroyed by certain infections known as venereal diseases.

We know that a healthy body makes a more efficient man, whereas a diseased body may destroy that efficiency. Of the various diseases mankind is heir to, the venereal infections are pre-eminent as the destroyers of parenthood. More than 50% of sterility is due to Gonorrhea alone; whereas, Syphilis is responsible for so many diseased conditions that the famous physician, Osler, called it "the captain of the diseases of death." No one wants venereal disease, yet venereal disease is quite probable when one persists in "taking a chance."

In order to understand the extent of possible damage due to venereal infection, a brief resume of the normal functions and anatomical structure of the sex organs is herewith given for comparative study.

I. The Sex Organs
   A. The Male
      1. Penis - is the organ of copulation and contains three cylinder-like structures of erectile tissue, containing multiple spaces or lacunae which become filled with blood from the internal pudic arteries. This filling with blood produces the condition known as erection. Two of these cylindrical structures are known as the corpora cavernosa and one through which the urethra passes, is called the corpus spongiosum.
         a. The urethra serves the double purpose of urination and ejaculation of semen during the sexual act. The enlargement at the end of the penis is known as the glans. It contains numerous sensory bodies known as Pacinian Corpuscles which receive sexual stimuli during copulation. These stimuli go to the sex center in the spinal cord by way of the pudendal nerve. The glans penis is usually covered by the foreskin or prepuce, unless circumcised for sanitary purposes.
      2. Prostate Gland - is about the size and shape of a horse chestnut and surrounds the neck of the bladder. It is chiefly a glandular structure and consists of several divisions known as lobes. These contain numerous tubules and secretory epithelium. The prostatic secretion together with the contents of the seminal vesicles make up the semen.

In a large percentage of older men this gland becomes large or hypertrophied and interferes with urination. In these cases, sometimes it becomes necessary to remove it surgically in entirety or to partially remove the enlargement through the penis, by an operation employing special instruments known as a prostatic resection.

3. Seminal Vesicles - are two sac-like structures located posterior to the prostate on the lower sac portion of the bladder. The chief function is that of a reservoir for the spermatozoa after they leave the testes and until ejaculated. The seminal vesicles also secrete a fluid which is added to that of the spermatozoa and prostatic secretion to form the semen.
4. Vas Deferens - are two muscular tube-like structures that conduct the spermatozoa from the testes to the seminal vesicles. The junction of these tubes forms the ejaculatory duct which terminates in the prostatic urethra. The sensation at the time of ejaculation known as an orgasm is largely due to the peristaltic pulsation of the Vas Deferens.
5. The Testicles - are the glands of reproduction. They are located in the sac or bag known as the scrotum. They are highly specialized organs serving a dual function. Besides producing spermatozoa necessary for reproduction or parenthood, they also elaborate an internal secretion that is necessary for the secondary characteristics of the man, such as voice, masculine stature, beard and hair distribution.

   Each testicle is covered by a fibrous sheath which also divides it into about 150 segments; each one containing from one to three tortuous tubules lined with specialized germinating epithelium from which the male seed or spermatozoon is developed.

   On the back portion of the testis and part of it is a convoluted tubular structure known as the epididymis. As the spermatozoa pass through it to the seminal vesicles their development continues. Destruction of the epididymis, and vas deferens by disease or other methods, accounts for most sterility in the male.
6. The Spermatozoon - sometimes called the male seed, is produced in the germinating epithelium of the testes. It averages about 1/500 of an inch (.05 mm) in length and consists of (1) a head containing the chromatin elements; (2) a body or middle piece which contains the centrosome and (3) a tail which serves the function of locomotion only.

B. The Female

1. The Labia Majora and Minora - these are lip-like structures located on either side of the vagina. Their functions are chiefly sensory and protective. Within

both labia majora is a gland known as Bartholin's Gland, the secretion of which empties, via a duct, into the vagina. The labia majora join at their upper portion in an elevated fatty mound known as the mons veneris. This is covered with hair as a protective measure.

2. The Clitoris - this is a miniature penis, minus the urethra, and therefore, is called a homologue of the male penis. Its only function apparently is that of a sensory organ.
3. The Vagina - this is the female copulation organ and depository vault. The spermatozoa travel up in the uterus from the vagina where they are deposited at the time of ejaculation.
4. The Uterus or Womb - this is the birth chamber wherein the fertilized ovum becomes entrenched and normally develops for nine months. Nourishment and blood supply for the fetus is obtained from the mother through special blood vessels that develop in the walls of the uterus. At term, or after nine months development, the mother gives birth to a child.
5. The Fallopian Tubes or Oviducts - are two tubular structures located on either side of the top or fundus of the uterus. They conduct the ovum to the uterus by means of a rhythmic pulsation of their walls.
6. The Ovary - the ovaries are similar in function to those of the testes. That is, they produce the ovum, as well as an internal secretion necessary for the development of the female secondary characteristics, such as the female stature, voice and hair growth and distribution.
7. The Ovum - is the female egg of reproduction. It is about 1/125 of an inch (0.2 mm) in diameter and develops in the Graafian Follicles of the ovary on an average of one about every 28 days. In each ovary it is estimated there are about 35,000 of these follicles. As a rule the ovum becomes fertilized in the infundibular portion of the Fallopian Tube from whence it passes down into the uterus for subsequent development.

THE VENEREAL DISEASE MENACE

Of all the diseases in the medical category, the venereal diseases stand out as the most prominent destroyers of human vitality, family possibilities and even life. No single disease is as responsible for destroying parenthood ability as Gonorrhea. On the other hand, Syphilis may invade all the various organs of the body and nervous systems producing degeneration and even death. Syphilis alone is credited with causing about half a million deaths a year.

The percentage of population previously infected with Syphilis according to statistics recently compiled by Dr. Thomas Parran, Surgeon General of the United States Public Health Service, indicates that from 88 to 145 of every 1000 persons in various sections of the United States have Syphilis. An impression of its chronicity or tendency of the infection to remain active in a person's body may be obtained from the figures of Haustein which suggest that twenty times more persons have Syphilis than contract it each year.

From the economic standpoint, Williams estimates that ten men insane from Syphilis represent a net loss based on life expectancy of $212,248,000. Reference: "Modern Clinical Syphilology" by Stokes. Estimating 12% of insanity is due to Syphilis, in the 180,000 persons insane in the United States in 1910, the economic loss due to Syphilis alone based on earning capacity and cost of treatment was $467,000,000. (All statistics are from "Modern Syphilology" by Stokes.)

PROSTITUTION - Most common course of venereal infection is from the prostitute, either professional or amateur. As a rule, the street walker is more apt to be infected than the professional prostitute, as the latter, in some cases, is subject to medical examination; whereas, the street walker seldom submits to examination unless forced to. In a survey of prostitutes in one of our large cities, more than 80% of prostitutes examined had either Gonorrhea or Syphilis or both. It is safe to say that all prostitutes, sooner or later become infected so the best preventative is abstinence.

VENEREAL DISEASES

The four most common venereal diseases we will briefly consider are Syphilis, Gonorrhea, Chancroid and Lymphogranuloma Venereum.

A. Syphilis
   1. Approximately half a million people die yearly from some syphilitic infection. Syphilis may develop quite early after infection and be manifested by definite diseased

conditions. It may not show up for a number of years after the infection is contracted. The victim may be ignorant of any syphilitic condition until in the course of a general examination a Wassermann blood test may give him his first information.

2. Syphilis can also be transmitted congenitally to the new born and manifest itself early or later during the development of the child, robbing him of his heritage of good health.

   a. Etiology - the specific organism that causes Syphilis is called the spirochete pallida. It was first identified in March, 1905, by Fritz Schaudinn and E. Hoffmann, (Schaudinn, the parasitologist and Hoffmann, the syphilologist). It is a corkscrew-shaped organism from 4 to 20 microns in length, having spiral turns equally spaced and with flagella at either pole. It is capable of moving in three directions, namely, in direction of the poles, sideways and rotating on its axis. It is found in moist lesions, especially the chancre and recognized by a Darkfield microscopic examination.

   b. Stages of Syphilis

      (1) Primary stage - the lesion of this stage usually appears two to six weeks after the infection is contracted. It is a punched out ulcerated area with indurated borders known as the chancre or hard chancre. When of sexual origin, the chancre usually appears on the genitalia, penis or pubic region in the male and labia or pubic region in the female.

      Chancres may develop on the lips from kissing a syphilitic or from the use of infected drinking cups or smoking cigarettes previously smoked by a syphilitic. They may also result from accidental infection on the fingers or other parts of the body with infected instruments.

      (2) Secondary stage - the secondary stage appears one to two months after the chancre appears or two to three months after infection and is manifested chiefly by certain skin lesions which are quite similar in appearance to other skin diseases. Preceding or accompanying these lesions, certain general symptoms may develop such as malaise, aching pains in bones and joints which are worse at night. Anemia may develop. Mucous patches may develop in the mouth. Hearing and sight may become impaired. The glands become enlarged and hair falls out in patches. Usually in this stage of the disease, it is not definitely diagnosed without a positive Wassermann test to prove its identity.

(3) Tertiary stage - about two years after a syphilitic infection, various lesions develop which affect the skin and deeper tissues, especially the bones and viscera.

The chief lesions that develop are gumma, fibrosis and ulceration, which do not tend to heal and cause degeneration and destruction of tissues involved. Of the viscera, the testes, liver, spleen, heart and lungs are most commonly involved. Bones may become thin and brittle and fracture easily or produce the characteristic knee joint enlargement known as Charcot's joint.

In the case of the spinal cord a gummatous lesion develops, causing a chronic inflammation of the enclosing membrane, which may result in locomotor ataxia (tabes dorsalis). Gummata may also affect the bones of the skull, as well as the soft tissues. In case of brain involvement, a softening may take place producing a form of insanity known as paresis.

3. Congenital Syphilis

a. Syphilis may also be transmitted to the new-born before or during birth and manifest itself about three months after birth or later in life. Both mental and physical changes may take place. Gradual deafness, blindness and characteristic teeth development are common in the child.

b. Stokes in Modern Clinical Syphilology claims that congenital Syphilis, a term widely used in place of heredo-syphilis may be applied more strictly to that type of the disease which follows the infection of the fetus in passing through the birth canal. Congenital Syphilis is thus a form of acquired Syphilis. Its course differs considerably from that of the prenatal or heredo-syphilitic type. Stokes says that the latter involves an overwhelming of the child with the organisms whose thoroughness often surpasses anything seen in the acquired form of the disease. Pinard and Hock (1920) claimed to have demonstrated the spirochetes in the semen in three out of eleven patients, whereas, Engman and Eberson found them in the semen in two out of seventeen patients.

c. Congenital Syphilis may be transmitted to the child in either of the following ways:

(1) Paternal - the infection accompanies the semen; about 40% of the children thus infected are either stillborn or die in early infancy.

(2) Maternal - the mother had Syphilis before conception, the ovum becoming primarily infected. Child mortality is about 80%.

(3) Mixed Infection - both parents have Syphilis and transmit it to the new born child. Mortality is approximately 90%.

(4) Post Conceptional Syphilis - the mother becomes syphilitic after conception has taken place and transmits the infection through the placenta.

B. Gonorrhea

1. Gonorrhea or Neisserian infection is the most prevalent of the venereal diseases. It is estimated that approximately 60% to 70% of the population has or has had Gonorrhea infection.
2. Gonorrhea is caused by a specific non-motile parasitic biscuit-shaped gram-negative organism known as the diplococcus of Neisser or the gonococcus.
3. The gonococcus was identified first by Neisser in 1879. When the stained smear is studied under the microscope, the gonococcus is seen in acute cases within the pus cells, hence called intracellular and look very much like coffee beans with flattened surfaces adjacent.
4. Gonorrheal urethritis appears three to six days after infection with smarting on urination, itching penis and scanty discharge. Later the discharge becomes more profuse and micturition may become more painful, especially if ulceration of the mucous lining of the urethra takes place. Associated symptoms usually are malaise, pain in the small of the back, tenderness in the perineum and constipation. Direct complications are prostatitis, cystitis, seminal vesiculitis and epididymo-orchitis. The most common complications from absorption of the gonotoxin or the blood stream invasion of the gonoccus, or mixed infection, are gonorrheal rheumatism, endocarditis, lumbago, sciatica and neuritis. Accidental infection of the eyes produces a specific conjunctivitis, which, if not cured, may produce ulceration or even blindness. In new born babies, physicians put medicine (silver nitrate or argyrol) into the eyes to prevent ophthalmia neonatorum, or blindness of the new born from gonorrheal infection received from the mother in the birth canal.
5. Gonorrheal infection is responsible for more than 50% of sterility in men by its destruction and closure of the spermogenic tubules, the epididymis or the Vas Deferens. In women it is responsible for about 90% of sterility and 70% of all pus operations of the abdomen.

C. Chancroid

Chancroid or soft chancre usually occurs on the penis in the male and labia in the female. It is caused by the streptobacillus of Ducrey or a mixed infection and appears as one or more papulopustular lesions which appear two to three days after infection. These rapidly break down into multiple soft bordered ulcerated areas, somewhat painful to touch and have more or less purulent discharge. A common complication is abscessed involvement of the inguinal glands known as Bubo.

D. Lymphogranuloma Venereum

This infection may occur as a small trivial lesion in the genitalia or rectum and is due to a filtrable virus. From the initial sore it may become a systemic disease involving the glandular system. Multiple areas of softening may develop, as well as strictures and fistula formation, involving the genitalia as well as the rectum. The specific diagnosis is made by the Frei Test.

COMPLICATIONS OF VENEREAL DISEASES AND ASSOCIATED CONDITIONS

STRICTURES - they may occur in any part of the urethra, but occur chiefly in the more vascular portions like the penile and membranous urethra. They result from either a severe infection, usually Gonorrhea, or strong medication, causing a pronounced inflammatory condition of the lining of the urethra with ulceration, after which scar-like tissue develops, causing a contracture of the urethra. When persistent, careful dilation with sounds is necessary at definite intervals; first to dilate the constriction, then to keep it open.

HYPOSPADIAS - sometimes a congenital defect of the urethra develops whereby the urethral opening is beneath the location of the normal opening - this is called hypospadias.

EPISPADIAS - similar to hypospadias, but opening is above.

BUBU - this is a pustular infection of the inguinal glands and is a common complication of the venereal infections: lymphogranuloma venereum, granuloma inguinale and chancroids.

VARICOCELE - this is an enlargement of veins in the scrotum resembling a "bunch of worms". The vein walls are over-distended and engorged with blood. This is not due to venereal infection and is not a serious condition. Surgery is one of the chief corrective measures for this condition.

HYDROCELE - this is a watery accumulation in the scrotum between the linings. It is usually secondary to injury and although not serious, may be annoying at times. Aspiration with proper asepsis will give relief, but permanent relief is obtained by means of surgery or in some cases, by injection of certain medication into the sac. It is important not to confuse hydrocele with a complete inguinal hernia into the scrotum, but differentiation can be readily made by transillumination of light. In the case of hydrocele, light from a flash light placed against the scrotum can be seen through the tumor mass or swelling; whereas, in case of hernia, it cannot.

PEDICULOSIS (Crabs) - an infestation in the hairy portions of the genitalia and rectum with a louse similar to a body louse, which is contracted by body contact with someone having them or which may be acquired from infested places, such as toilet seats. They may be gotten rid of by either shaving the hair in infested areas, or use of calomel powder, or blue ointment, or a copper solution, such as Cuprex.

SKIN DISEASES - various types of skin diseases resemble similar lesions in Syphilis and to the untrained eye may easily be mistaken for Syphilis. Clinical diagnosis in these cases is usually made more certain by the Wassermann blood test.

ARTHRITIS - there are various forms of arthritis, caused by different infections. However, it is one of the most common complications of a severe case of Gonorrhea, especially "when the infection gets into the blood." In these cases, usually the knees, wrists or ankles are first affected, after which general involvement may take place. Treatment in these cases is two-fold, first that of the specific infection, Gonorrhea, and secondly, the complication, Arthritis. Baths, packs, diathermy, diet, internal medication and sometimes vaccines are used. However, "fever therapy" and the high frequency baking apparatus shortens its duration. Usually the condition is quite painful and the treatment takes a long time.

NOTE: WASSERMANN BLOOD TEST - is a test for syphilitic infection based upon a complement fixation which prevents hemolysis or breaking down of red blood cells.

When the red blood cells are not broken down, there is a negative hemolysis or positive syphilitic reaction.

If the blood cells are broken down, there is a positive hemolysis or negative syphilitic reaction. Materials required in making a Wassermann test are:

1. Antigen from a beef heart.
2. Blood serum from the patient.
3. Red blood cells from sheep.
4. Amboceptor from rabbit.
5. Complement from guinea pig.

KAHN TEST - a modification of the Wassermann test. It is a precipitation test for Syphilis.

KOLMER'S TEST - a modification of the Wassermann wherein a specific complement fixation method is done.

TREATMENT

A. Prophylaxis

1. Regulations require that an enlisted man report immediately or as soon as possible after exposure to the prophylactic station for prophylactic treatment. If not, and he acquires a venereal infection, he is liable for punishment and is hospitalized without pay for a course of treatment. Prophylaxis, if taken within an hour after exposure, is 90% effective and only 50% effective if taken in three hours. After that, the efficacy rapidly decreases.
2. Prophylaxis is given at station.
   a. Regulation report made out.
   b. Genitals washed with green soap solution.
   c. Genitals washed with Bichloride of Mercury (1-2000) solution.
   d. Injection of 2% Protargol solution into the urethra - held about 5 minutes.
   e. Genitals treated with calomel salve.
   f. Protective covering over genitals.

B. General

1. It is universally agreed that Syphilis should be treated two years or more, depending upon the Wassermann reaction. Of the various drugs used, three stand out as more or less specific: arsenicals, bismuth and mercurials.
2. In treatment of Gonorrhea, more diverse methods may be used. Some prefer the combined treatment of internal medication with urethral injections or irrigations. Some depend upon internal medication alone; whereas, others give the internal medication together with some form of a vaccine. Various drugs are used in its treatment, but during the past three or four years one or more of the sulfonamides have been used with considerable degree of success. Improper or unwise use of these drugs may produce harmful effects due to their toxic effects upon the blood and circulatory systems.
3. Chancroids and Lymphogranuloma are treated locally, primarily but the sulfonamides are also used internally, especially in the treatment of Lymphogranuloma Venereum.

A soldier who contracts venereal infection should not temporize or jeopardize his health through self-treatment or experimental treatment. He should go on sick call immediately and take the prescribed treatment as thoroughly as he would in case of any other serious type of infection.

NURSING

INDEX

INTRODUCTION TO NURSING

A. The purpose of this training you are to receive is to prepare you as "Technicians", so you can efficiently nurse medical and surgical patients. A surgical patient is one who has undergone an operation, been badly burned, or injured (i.e., gun-shot wound or broken leg). All other patients are classified as medical patients.

B. Essentials of good nursing methods.
   1. Any nursing method used must be scientifically sound. That is to say, it must be based on such sciences as Anatomy, Physiology, Bacteriology, etc.
   2. Any nursing method used must be acceptable to the patient. It must be (a) safe, (b) effective and (c) carried out in a manner that provides him with all the comfort possible.
   3. The technician carrying out the treatment must know (a) why it is given, (b) how it is given, (c) what symptoms to expect during and after the treatment, and (d) results to be expected from the treatment.

C. Points to be remembered:
   1. Support carefully and securely the patient's body when necessary to move him.
   2. Adjust and watch carefully any mechanical devices used on the patient (i.e., oxygen mask).
   3. Prevent fires by keeping matches and other inflammable materials from irresponsible patients.
   4. Take care to keep inflammable anesthetics such as ether from sparks and open flames.
   5. Avoid using force in handling tissues during dressings and treatments.
   6. Avoid long continued pressure on patient's body due to splints, bandages, and position in bed.
   7. Use correct degree of heat or cold when these agents are applied.
   8. Carefully check and be sure the medicine you are giving the patient is exactly what is ordered and that you have the correct dosage.
   9. Keep your own body and dress clean and neat, wash your hands well with soap and brushes, or a disinfectant between care of patients and treatments.
   10. Use proper sterilization methods and technique to protect yourself, as well as the patient.
   11. Have your ward properly lighted and ventilated. (i.e., warm when bathing and cool when sleeping).
   12. Keep your ward "QUIET".
   13. Keep your equipment clean and in good condition so it is always ready for use at a moment's notice.
   14. Keep an eternal watch for untoward or dangerous symptoms on all your patients and accurately record such on the patient's chart.

15. Keep your patient mentally at ease. This means that every treatment you give must be done efficiently so as to develop the patient's confidence. Make your movements gentle, deft, sure, and yet firm. Do your work in an orderly, well planned manner, so that you leave your patient improved to the greatest possible degree, physically and mentally. Tell him what you are about to do, and what symptoms he can reasonably expect from your treatment (i.e., in giving a hypodermic, tell him he will feel only a pin prick and not to jump and so prevent breaking a needle).

SYMPTOMS

DEFINITION: A symptom is any evidence of a patient's condition.

TYPES:
1. Objective - an objective symptom is anything you can tell about a patient's condition with one of your five senses. (Sight, hearing, touch, taste, or smell). i.e., you can *see* a swollen area of skin; you can *hear* the way a patient breathes; you can *feel* the ends of a broken bone grate together; you can *smell* the odor of a patient's breath.

   The vast majority of symptoms are *objective* symptoms.
2. Subjective - a subjective symptom is anything about a patient's condition of which the patient complains, and which you cannot tell with one of your five senses; i.e., pain, itching, tenderness, chilly feeling, feeling of warmth, nausea (desire to vomit).

OBSERVATION OF SYMPTOMS: The observation of symptoms is part of the technician's work that he carries out the entire time he is on duty. The technician observes symptoms when he walks through the ward, gives a bed bath, administers a hypodermic, and whenever carrying out any of his other duties. This is important because the technician is one individual who is with the patient the greater part of the day. The medical officer sees the patient for a few minutes two or three times each day, thus it becomes the responsibility of the technician to determine any change in the patient's condition and report to the medical officer when necessary.

WHAT TO OBSERVE: There are three main groups of symptoms that the technician must learn as he becomes more and more efficient in his work:

1. Symptoms caused by the disease with which the patient suffers.
2. Symptoms relating to nursing care, i.e., cramps that result from too rapid administration of enema fluid.
3. Symptoms caused by the medicine given to the patient, i.e., morphine produces slow breathing, drowsiness and pin-point pupils. Quinine causes ringing in the ears and drunk-headedness.

Each student is to read over the following material several times: Medical Department Soldiers' Handbook, paragraph 200, "Symptoms", pages 202 through 205, inclusive.

TEMPERATURE: Every living person has a certain normal temperature (body heat). This temperature or body heat is largely produced when the food you eat is metabolized (burned up or used) by the body cells. This temperature in health remains fairly uniform. In many diseases, the body temperature changes from its normal. Whenever the body temperature goes above the normal, the patient is said to have "fever" or "elevation of temperature". This change can be caused by several different conditions, the most important of which is infection by bacteria (germs). Whenever the body temperature goes below normal, the patient is said to have a "subnormal" temperature. There are several different conditions which cause subnormal temperature, the most important of which is "shock". Whenever you find a patient with a subnormal temperature, you will consider the patient in shock until proved otherwise.

A patient's temperature is determined by the use of a thermometer. The bulb of the thermometer contains mercury (quicksilver). The heat of the patient's body causes the mercury to expand and rise in the stem. By means of the lines on the stem, we tell the patient's temperature by reading the line to which the mercury has risen. Each long line represents one degree of heat. Each short line represents two-tenths (2/10 or .2) of a degree of heat. A degree is a certain amount of heat and is our way of measuring heat. The degree is always abbreviated by the following sign (°).

When a thermometer is not in use, it stands in a sterilizing solution. The sterilizing solution may be 70% alcohol or 1-1000 solution of Bichloride of Mercury. A thermometer must remain in one of these solutions one hour before it is considered sterile. The thermometer must always be sterile before using. At Brooke General Hospital a 25% solution of cresol is used for sterilizing thermometers. Ten minutes in this solution is considered sufficient for sterilization, and before placing in patient's mouth, rinse off with alcohol and tap water. There are three sites in the human both where the temperature is commonly taken, i.e., in the mouth, the rectum, and the axilla (arm pit).

1. Mouth (orally) - an oral thermometer is removed from the sterilizing solution and washed in tap water. After shaking down the mercury, it is placed under the patient's tongue and the patient instructed to keep his lips closed tightly for three minutes. The normal body temperature when taken orally is 98.6° F. After reading, the thermometer is wiped off and replaced in the sterilizing solution.

2. Rectum (rectal) - A rectal thermometer is removed from the sterilizing solution and washed with tap water. The bulb end is lubricated with lubricating jelly or mineral oil and inserted about one inch into the anus. During the five minutes the thermometer remains in the rectum, it is held in the technician's fingers so that it can be quickly removed if the patient should attempt to move about. Normal body temperature when taken by rectum is 99.6° F. After reading, the thermometer is wiped clean with cotton and replaced in the sterilizing solution. The rectal route is used where it is difficult to take an oral temperature in such cases as follows:
   a. Unconcious patients.
   b. Delirious patients.
   c. Patients having difficulty in breathing.
3. Skin (axillary) - an oral thermometer is removed from the sterilizing solution and washed with tap water. After shaking the mercury down, it is placed in the axilla and the arm lowered against the chest, leaving the thermometer in place for five minutes. After reading, it is replaced in the sterilizing solution. Normal body temperature taken in this manner is 97.6° F. Of the three ways to take temperature, this is the least accurate of them all and thus we always take an oral or rectal temperature, if possible.

Whenever recording a temperature reading on the patient's chart or when giving a patient's temperature reading verbally, it is absolutely essential to state in which of the three sites it was taken.

Factors Causing Inaccurate Temperature Reading:

1. Failure to keep the thermometer under the tongue.
2. Failure to keep the thermometer in the mouth three minutes or in the rectum five minutes.
3. Mouth-breathing or holding the mouth open while the thermometer is present.
4. Ice or ice water in mouth just before inserting the thermometer.
5. Patient deliberately placing the thermometer against radiator, ice bag, hot water bottle, etc.
6. Inaccurate thermometer.

Factors Influencing Temperature:

1. Infection.
2. Shock.
3. Drugs.
4. Exposure to extremes of cold or heat.

5. Exposure to heat producing electrical current.
6. Conditions of some of the glands of internal secretion, (i.e., thyroid).
7. Vaccines.

PULSE: This is the beat of an artery. The system of elastic pipes that carry blood from the heart to the various organs of the body are called arteries. Every time the heart beats, it pushes into the arteries a large amount of blood, which causes the elastic arteries to expand. Then the arteries contract which serves to move the blood further along in the circulatory system. This rise and fall of the artery which occurs with each heart beat is called the "pulse". The pulse may be determined by placing your fingers on any artery close enough to the surface of the body to be felt. Most of the arteries are placed deep in the body and there are but three or four that can be easily felt. The most frequent place to take the pulse is in the wrist at the base of the thumb. Here we can feel the Radial Artery which carries blood to the hand. It is usually felt by placing the tips of the forefinger and middle finger on the artery. It is not possible to use your thumb to feel the pulse beat because there is a fair size artery in your thumb, the beat of which might be counted in case the beat of the patient's pulse is very weak or thready.

Whenever you take the patient's pulse, you must notice three factors:

1. <u>RATE</u> - by the rate we mean how fast or how slow the pulse is beating. It is determined by counting the number of times the artery beats in one minute. The pulse rate of a normal person at rest is 72 beats per minute.
2. <u>STRENGTH</u> - by this we mean the force with which the expanding artery hits your finger. The force, or strength or volume can be described by the words "weak", "normal" and "strong". "Thready pulse is a weak pulse. "Full" pulse is a strong pulse.
3. <u>RHYTHM</u> - This concerns two characteristics of the pulse:
   a. The spacing or lapse of time between beats.
   b. The force or strength with which the expanding artery hits your finger.

   Rhythm is described by the two words "Regular" and "Irregular".

   A pulse of regular rhythm is one with timing between beats all alike and the strength of the beats alike. An irregular pulse is one where the time intervals between beats vary, or the strength of the beats vary, or both of these changes from the normal exist.

There is one type of pulse often seen following operations or injuries that is usually a danger symptom and must be reported immediately. With this pulse, as time passes, the rate becomes faster and faster. It is a symptom of great danger when at the same time it becomes progressively weaker (thready). It is most serious when added to the above change in rate and strength; the rhythm becomes irregular.

Normally the pulse rate will increase 5 to 10 beats per minute with each degree rise of temperature above the normal.

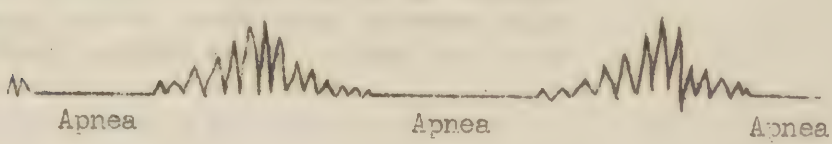
RESPIRATION - By respiration is meant breathing. Whenever you observe a patient's breathing you must notice five factors:

1. Rate - the normal rate of breathing of a man at rest is 18 times per minute. It is counted by holding a watch in your hand and counting the number of times his chest rises and falls in one minute.
2. Depth - By this we mean how much his chest rises and falls with each breath. It can be described by the words: "shallow", "normal" and "deep".
3. Rhythm - this concerns two characteristics of the breathing:
   a. The time interval between breaths.
   b. The depth of the breathing.
   Rhythm can be described in two words: "regular" or "irregular". In regular rhythm all breaths are the same depth and the time intervals between breaths are all alike. In irregular rhythm the depths of the breaths may differ, the time interval between breaths may differ, or both of the above may be present.
4. Ease - this has to do with the amount of effort the patient has to exert in order to breathe. Ease can be described by the words, "easy" (normal) or "labored" (Dyspnea).
5. Pain - this may be described by the two words, "painless" or "painful".

Apnea - is lack of breathing. A patient will go for thirty or sixty seconds without breathing in apnea.

Dyspnea - labored breathing or great difficulty in breathing. Most cases of dyspnea are greatly aided by placing the patient in a sitting or semi-sitting position.

Cheyne-Stokes Breathing - an irregular type of breathing where the breaths are very shallow, become progressively deeper, then progressively shallow and finally apnea. It is usually a symptom of approaching death.



BLOOD PRESSURE - by blood pressure is meant the force with which the blood flows through the arteries. The heart is the pump and each time it beats, it pushes the blood within it into the arteries with a great amount of force.

The three main factors on which blood pressure depend:

1. The strength of the heart beat - the stronger the heart beat, the greater the force (blood pressure) it exerts on the blood as it is pushed into the arteries. The weaker the heart beat, the less the force.
2. The elasticity of the arteries or the beat of the arteries - Since a large amount of blood is forced into the arteries each time the heart beats, the elastic walls must stretch to receive it. Then the elastic walls contract and force the blood further along the arterial system.
3. The amount of blood made available for the heart to pump - the average man has between five to seven quarts of blood, depending on his size. Should this blood volume decrease, the blood pressure falls. A good example of this is seen in the ordinary water pump. If the pump does not have the necessary amount of water available to pump, the stream, as it comes from the pump, is small and has but little force. Increase the water to the pump and the stream produced by the pump is larger and has greater pressure to it. In hemorrhage, the blood available for the heart to pump decreases and so the blood pressure falls. In shock, the blood available for the heart to pump also decreases and so the blood pressure falls. In shock, the blood is pooled in the tiny capillaries which have dilated and so have greatly increased in size, thus making the amount of blood available for the heart to pump much less than normal. Also in shock, the amount of blood is decreased by some of the fluid part of the blood passing through the walls of the capillaries out into the tissues.

How to Take the Patient's Blood Pressure: The cuff is placed about the arm well above the elbow. Sufficient air is pumped into the cuff so that its pressure will cut off the flow of blood through the Brachial Artery. Listen with the stethoscope, placed gently yet firmly on the anterior elbow surface. The air is slowly released from the cuff by means of the valve attached to the rubber bulb. As the air pressure in the cuff falls, it finally reaches a point where the blood pressure in the Brachial Artery is able to force a small amount of blood past the constriction caused by the air cuff. At this point, a loud definite thud is heard each time a small amount of the blood is forced past the constricting air cuff, with each heart beat. The first reading is taken at this point and it is called the "systolic" blood pressure. For men in the army it will normally be between 105 and 140.

As more air is released from the cuff, more and more blood is forced by the blood pressure past the constricting air cuff. As this occurs, the thud heard with each heart beat becomes louder. Suddenly this loud thud will change to a very definite weak thud and the second reading is taken at this point. This reading is called the "diastolic" blood pressure. Its value in a normal man of army age is from 60 to 90.

Finally when the needle falls another ten or fifteen points, the pressure in the cuff becomes so low it causes no obstruction at all to the flow of blood through the brachial artery, and at this point the soft thud heard with each heart beat disappears. The two blood pressure readings are recorded as a fraction:

Systolic	115	(Average)
Diastolic	70	(Average)

GENERAL CARE AND COMFORT OF THE PATIENT

I. BED MAKING

A. The Closed Hospital Bed: a hospital bed not in use is called a "closed bed", and is made up in the following manner:

1. Materials required:
   a. Four cotton sheets
   b. One rubber sheet
   c. One mattress cover
   d. One pillow case
2. Turn the mattress from head to foot and cover with mattress cover.
3. Cover the mattress with a cotton sheet, wide hem to the head of the bed, folding it under at the head, foot and sides, leaving square corners. If the sheet is too short to fold under at both head and foot, fold it under at the head. This will keep the sheet from slipping toward the foot of the bed and wrinkling.
4. The "draw sheet" is applied only if the patient is likely to soil the bed. The draw sheet is made of a rubber sheet covered by a cotton sheet. Its purpose is to protect the mattress and to move the patient. The rubber sheet is placed on the bed extending from the level of the patient's shoulders to a level well below his hips. It is covered with a folded cotton sheet with the folded edge toward the head of the bed. Rubber objects are never allowed to come in contact with the patient's skin.
5. A blanket encased in two cotton sheets to cover the patient is now placed on the bed. Place one sheet on the bed with the wide hem to the head. Place the blanket on top of this sheet, pulling it down about six inches from the head of the bed. Cover the blanket with another cotton sheet, which extends about six inches above the blanket at the head. Fold the top sheet under the blanket's upper edge. Fold the under sheet over the blanket and top sheet at the blanket's upper edge. This protects the blanket's upper edge from spilled fluids or saliva. All three items are folded under the mattress at the foot with square corners.
6. The pillow is rolled between the hands to loosen the filling, and then placed in a pillow case by holding the pillow under your arm (never in the mouth). If the pillow case is too large, fold it in at the under side of the pillow. Place the pillow on the bed with its opening away from the entrance of the ward.

B. When to Change the Bed Sheets.

1. At least twice a week.
2. Between patients.
3. Whenever soiled.
4. Following a sponge bath.

C. <u>How to Change Sheets on an Occupied Bed</u>:

1. Have at the bed side the following supplies:
   a. Four cotton sheets.
   b. One rubber sheet.
   c. Pillow case.
2. Loosen the sheets all around the bed. Remove all the covers from the patient except one cotton sheet. Working in pairs, a technician stands on each side of the bed to keep patient from rolling out of the bed. Place the patient on his side on one edge of the bed in the following manner:
   a. Straighten out the lower limbs, and cross one leg over the other so that the upper points towards the side of the bed to which you desire to move the patient.
   b. The upper extremity on the same side is placed across the patient's chest so that the hand points towards the side of the bed to which you desire to move the patient.
   c. The other arm is straightened out on the desired side of the bed so that the patient will not roll upon it. Place one of your hands under the shoulder, and the other hand under the hip, and gently lift.
3. Remove the pillow. Start on the opposite side of the bed from the patient, roll the sheets into a tight roll close to the patient's body. Place a clean sheet on the uncovered side of the bed and fold it under the mattress with square corners. Place the draw sheet on the uncovered half of the bed in the same manner. Roll the remainder of the clean sheets into a small roll along side of the patient's body. Move the patient over to the clean side of the bed, remove the soiled sheets, unroll the clean and fold them under the mattress with square corners. Change pillow case and place the pillow on the bed. Spread a clean sheet over the patient and remove the old one. Place the blanket back on the bed and cover it with a clean sheet. Fold all three items covering the patient under the mattress with square corners, taking care that they do not press too tightly against the patient's feet. Do not throw soiled sheets on the floor when making the bed.

II. BATHS

A. Baths are given to hospital patients for several reasons, such as follows:
   1. To get the patient's body clean.
   2. To make the patient perspire (sweat).
   3. To bring down a high elevation of temperature.
   4. To quiet the patient down (induce sleep, relax nervousness).
   5. To stimulate the patient's circulation.

B. <u>Baths are classified</u> by the temperature of the agent used to bathe the patient:

1. Cold Bath - 60° F. to 70° F.
2. Tepid Bath - 90° F.
3. Hot Bath - 110° F.

C. <u>The Sponge Bath</u>:

1. The sponge bath is given to the patient in his bed, to cleanse his body. It is best given early in the morning before breakfast, or the last thing at night before going to sleep. If it is necessary at some other time of the day, wait at least one hour after meals. Great care should be exercised in giving the bath to the very sick, since their body resistance is low and respiratory infections may develop because of exposure to cold. The room temperature should be around 70° F. The windows are closed to prevent drafts, and curtains drawn around the bed.
2. The following items are necessary:
   a. Tub of water (110° F.).
   b. Kidney or emesis basin.
   c. Large rubber sheet.
   d. Cotton sheet.
   e. Bath towel and hand towel.
   f. Tooth paste and brush.
   g. Soap and wash cloth.
   h. Rubbing solution (70% alcohol - 30% boric acid) 300 cc.
   i. Talcum powder.
   j. Mouth wash.
   k. Nail file or orange-wood stick.
3. Protect the bed with a bath towel under or next to the area being washed. Keep the patient covered except for that part being bathed. Start with the head and work down to the pubic region, then start at the feet and work up to the pubic region, washing the pubic region last. Brush the patient's teeth with an up and down movement on all surfaces. Then rinse out the mouth with mouth wash. Shave the patient, if necessary, then wash the face, ears and neck with a small amount of soap, taking care to remove all the soap with the wash cloth and dry the skin well.

   Clean the patient's finger nails with nail file or orange-stick and trim the nails short. Wash one upper limb with soap, water and wash cloth and dry well. Do the same with the other upper limb. Now wash and dry the chest, abdomen and back down to the pubic region. Then start on the feet, exposing only one limb at a time. Trim the toe nails square across, and clean underneath them with a nail file. Wash and dry each limb in turn. Lastly wash and dry the pubic region (scrotum, penis, etc.) and perineum (around the anus).

Now that the skin of the entire body is cleaned the patient is given an alcohol rub and his back powdered. Turn the patient on his abdomen or side to expose the back. Pour the alcohol-boric acid solution into the palm of your hand and apply to the skin with a brisk massage until dry. All the posterior surfaces of the patient (neck, chest, shoulders, lower back, buttocks and lumbs) are rubbed and massaged with the solution.

When doing the back, begin at the spine with one hand on each side and work the palms outward with a circular motion, thus moving the underlying muscles. Continue in this fashion until the entire back has been massaged.

Following the rub, apply talcum powder freely to the patient's body, especially those parts in contact with the bed. This will keep the skin dry by absorbing his sweat.

D. The Sweat Bath: the sweat bath is given to a patient in a bath tub or in his own bed for the purpose of making the patient perspire (sweat) to rid his body of toxic materials.

1. Tub Sweat Bath - fill the tube half full with water at 110° F. To be sure your water is of the correct temperature, use the bath thermometer. The patient is slowly lowered into the tub feet first until he is submerged up to his neck. An ice bag or cold compresses are placed on his head. The length of time the patient remains in the tub of hot water varies from 10 to 20 minutes. What you are trying to accomplish is to get the patient to perspire well 1/2 to 1 hour, in which time he would be able to sweat 1 liter of perspiration out of his system. The sweating process is started by the hot water. Watch his face, and when this skin area has freely perspired for 10 minutes, you can be sure that the sweating process is well established over the rest of the body. Remove the patient, after this 10 minute period of perspiration; do not dry, but wrap him in dry blankets in bed. Now that the sweating process has started, keep him in those blankets for 1/2 to 1 hour (as long as the process continuos). During this period, give the patient hot fluids to drink, unless there is a definite order to the contrary. After this period, move the patient to a dry bed for one hour. Then give the patient a sponge bath and alcohol rub to clean his skin.

Throughout the whole procedure, and especially during the 10 to 20 minutes the patient is in the tub of hot water, watch carefully for untoward symptoms. Especially, notice the pulse. If it becomes very rapid or weak, or both, it is best to remove him from the hot water at once and wrap him in the warm blankets. Should the patient complain of feeling faint, or very weak, it is best to remove him from the hot tub, even if the sweating process has not become well established.

2. Hot Air Bed Bath - protect the mattress by a rubber sheet covered by a cotton sheet. Strip the patient and place on the protected mattress. Place over his body a cradle so as to form a tent with a sheet or blanket. Only the patient's head is outside the tent. Hang on the cradle four to six electric light bulbs of ordinary size to heat the air about his body. Place along side the patient in bed a bath thermometer so that you can always tell how hot the air is about his body. When the air about his body reaches a temperature of 110°F. to 115°F., turn off or loosen in their sockets enough of the electric light bulbs so that the temperature goes no higher. Watch for the start of the sweating process, and time it so that the patient perspires about 1 hour. During this period, give him hot liquids to drink and keep cold compresses or ice bag to his head. Also watch well for untoward symptoms such as rapid pulse or feeling of faintness (which might be a signal to stop the treatment). At the termination of the treatment, place the patient in a dry bed, give him a sponge bath and alcohol rub and powder his body.

E. The Cold Bath - the cold bath is given to the patient for the purpose of reducing his temperature.

1. Cold tub bath - the cold tub bath is also called the "Brand" bath. Fill a bath tub half full of water around 90°F. Lower the patient into the tub slowly, to avoid shocking him, feet first. Have all of his body covered by the tepid water except his head and neck. Ice or ice water is now added to the tub to reduce the temperature of the water to 60°F. - 70°F. The patient remains in the tub of cold water until his oral temperature reaches 100°F. or less. The duration of the bath is 15 minutes or less. During this period, while the patient is in the cold water, his body surfaces are vigorously massaged. Rub vigorously any skin surface you can reach under the water. This massage serves to bring the flow of blood to the skin so that the cold water may more quickly bring down the temperature of his body. Watch for untoward symptoms such as blue lips or finger-tips, marked shivering of the body muscles, marked chattering of the teeth, and the patient complaining of being too cold or that he is going to have a chill. Should such symptoms appear, it is best to discontinue the bath even if the desired temperature has not been reached.

2. Coldpacks - protect the mattress with a rubber sheet covered by a cotton sheet. Two folded cotton sheets, dipped in water at 70°F. and rung out, are placed under and over the patient's body. Remove and redip these sheets as soon as they lose their chill (about every 5 to 10 minutes). A half hour of these packs produces the effect of 10 to 15 minutes in the tub of cold water. Continue the packs until the temperature orally is 100°F. or less, provided no untoward symptoms develop. It is not practical to massage the skin surfaces when using the sheets.

II. BED SORES

A. Definition: a bed sore is an ulcerated area on the patient's body due to pressure from a long period of confinement in bed. Other names for the same condition are "Decubitis" and "Pressure Sores". They are especially likely to occur in the poorly nourished patients or those with long exhausting illness and poor circulation.

B. Symptoms: early is seen a blanched area that quickly turns red when the pressure is relieved. These areas are most likely to be noted over bony regions (heels, hips, shoulder blades, lower spine, elbows, back of head). At this same time, the subjective symptoms of numbness, tingling or soreness may be present. They may bother the patient to such a small degree that you may have to ask him if he senses such. There is little or no pain associated with this condition. Do not wait for the patient to complain of pain before being on the watch for bedsores. If the pressure is not relieved, the poor circulation of blood to the area will remain, and the next symptom to develop is a small break in the skin. This means that some of the skin cells have died from lack of proper blood supply and have separated from the rest of the skin. If the pressure is not relieved, the break becomes larger making a large ulcer.

C. Causes:

1. Constant pressure on an area (thus preventing proper blood flow into the area).
2. Prolonged illness confining the patient to bed.
3. Moisture (sweat, urine, stool, bath water, pus and other discharges).
4. Heat.
5. Friction (wrinkled sheets, crumbs).
6. Poor circulation as in heart disease, kidney disease, lack of exercise.
7. Obesity (fat) and emaciation (wasted).

D. Prevention:

1. Watch for the early symptoms, especially over the bony prominences.
2. Change patient's position in bed every hour or so.
3. Proper bathing to keep the skin clean and dry.
4. Proper alcohol rubs to toughen the skin, cut down perspiration and provide exercise.
5. Proper bed making and keep sheets free of wrinkles. Keep bed clean and dry.
6. Proper powdering of the body after baths and rubs to adsorb the sweat.
7. Prompt cleansing of the skin as soon as it is soiled by urine, stool, pus, etc.
8. Use of rubber rings, air mattresses, cotton doughnuts, pillows, etc. to relieve pressure on any area that shows the early symptoms.

E. Treatment: the best treatment is to PREVENT them from developing. In the early stages before the skin is broken, all the treatment necessary is to relieve the pressure from the area, so that it may receive proper blood supply, and the symptoms will promptly disappear. In the later stages where there is a definite break in the skin or a large ulcer:

1. Relieve all pressure.
2. Cover with a sterile dressing to keep out all germs. Balsam of Peru, a 5% Sulfathiazole or Sulfanilamide ointment, 5% boric acid ointment, 5% Scarlet Red Ointment, etc., may be spread on the sterile dressing before applying to act as an antiseptic and to keep the dressing from sticking to the raw flesh.
3. Keep away from this bandaged area when giving baths, alcohol rubs and massage.

III. CARE OF THE MOUTH

A. Instructions:

1. Careful attention must be given to the oral cavity of the sick patient, for normally the mouth harbors many varieties of germs. In sickness, the body's powers of resistance to these germs may become so lowered that the germs can invade the mouth tissues to cause severe infection.
2. Brush the teeth after each meal, using a dentifrice (paste or powder) once or twice daily. Brush downward, away from the gums (never toward the gums).
3. Give the patient an alkaline mouth wash to use after each brushing of the teeth. If none of the regular ward mouth wash is available, use baking soda (1 teaspoonful to the glass) and water as a mouth wash.
4. Use dental floss to remove particles of food stuck between the teeth.
5. In cases of "Oral Sepsis" or poor oral hygiene, the gums become swollen, red, very tender and bleed easily. Pus and food debris collect around the teeth. A foul odor (halitosis) of the breath is present. When such a condition exists, you cannot use a tooth brush and dentifrice because of the tender gums; in place you must use cotton swabs to clean the mouth and apply mild antiseptics to the infected tissues. The following are of value:
   a. Hydrogen Peroxide (H_2O_2) mixed with water - half and half. This is used as a mouth wash or swabbed over the mouth tissues with a cotton swab.
   b. Sodium Perborate - one or two teaspoonsful dissolved in a glassful of warm water, used as a mouth wash or applied with cotton swabs.
   c. Chewing gum helps keep the teeth clean of food debris and pus.

IV. CARE OF THE LIPS

In the very sick patient the lips tend to become dried, swollen, cracked and tender. To combat this condition, the lips are painted several times daily with a mixture of glycerine and lemon juice, on a cotton swab. The mixture is prepared by placing about 1 teaspoonful of lemon juice in an ounce of glycerine. This mixture can be used on the tissues of the interior of the mouth also.

V. CARE OF THE NASAL CAVITY.

To prevent the nasal mucus membranes from drying out and cracking, and to clear the nose of dried and crusted mucus, mineral oil on a cotton swab is applied several times daily.

VI. CARE OF THE HAIR: keep the patient's hair cut. This may be necessary but once every two weeks; keep the patient's hair washed. This may be necessary but once each week. Keep the patient's face shaven. This is usually done each day or every other day.

A. Treatment for Head Lice: The proper name for the head louse is "Pediculus Capitis". The adult is the size of a head of a pin (1 mm. or 1/25 of an inch,) oval in shape and gray in color. The adult lays eggs, which are called "nits", and secretes a glue, to fasten the nits firmly to the hair of the patient's head. The nits look just like tiny flecks of dandruff. The treatment is as follows:

1. Shampoo the head well to wash out most of the adults.
2. Apply Tincture of Larkspur or Kerosene and oil (half and half) overnight (wrapping the head in a towel to protect the pillow). This destroys adults but does nothing to nits.
3. Shampoo to remove the Larkspur or oil the next morning.
4. Soak head in pan of warm vinegar. This dissolves the glue and so loosens the nits.
5. FINE COMB and shampoo out the loosened nits.
6. Check the head well every 2 or 3 days for the next two weeks for evidence of recurrence of the infestation. The eggs were not destroyed, but merely loosened by the acid vinegar. If a few are left behind, within 2 weeks they will develop into adults.

VII. TREATMENT FOR BODY LICE The proper name for the body louse is "Pediculus Corporus". The adult lives in the seams of the underwear, and so when the clothing is removed, all of the adults are removed. The eggs are deposited on the body's hair, but are not glued to the hair. A hot water and soap bath (shower) will remove all the eggs. Steam or hot water will destroy the adults in the clothes.

VIII. TREATMENT FOR PUBIC LICE: The proper name for the pubic louse is "Pediculus Pubis". The adult and eggs are found in the hair of the pubic region. Steam or boil the clothing. Apply Blue Ointment (33% Mercury Ointment) for several days (1 week) in a row.

IX. BED PAN

A. Instructions:

1. The clean dry bed pans are kept in the utility room on a bed pan rack or in a warming closet. If the pan has not been kept in a warming closet, it is placed under a flow of hot water, dried, and brought to the bed side covered with a bed pan cover. Screen the bed and remove the pajama trunks or pull the hospital gown well above the patient's knees. Stand at the side of the bed on a line with patient's hips, place your left hand under the small of his back and lift. Slip the pan into position with your right hand. The pan should comfortably support the buttocks. If the patient is emaciated (wasted) or has a bed sore, the bed pan cover is folded to form a pad and placed between the patient's lower back and the bed pan. It is very difficult for the patient to expel his feces when lying flat on his back. By elevating the knees and propping the patient into a semi-sitting or sitting position, he will be able to evacuate his bowels with greater ease. If the patient is able to clean his anus, place a roll of toilet tissue in his hand as soon as he is on the bed pan. If he is unable to clean his anus, the technician must clean it for him. This is best done before removing the bed pan by spreading the knees far apart to expose the anus. If necessary, use warm water, soap and wash cloth after using the toilet tissue. As soon as the patient is finished and the anus cleaned, remove the bed pan. Never leave the patient sitting on a bed pan while you go off to do some other task. To remove the bed pan, lift the small of the patient's back with your left hand, slip the bed pan cover off, if one has been used, and remove the pan from underneath the patient with your right hand. Cover the bed pan and remove from the ward at once. Before cleaning the bed pan, look at its contents so that you may properly record any abnormalities such as blood, pus, mucus, parasites and unusual coloring. Note also the amount, odor and consistency of the stool. If ever in doubt, save the specimen for the medical officer's inspection.

2. To clean the bed pan. Open the bed pan sterilizer by stepping on its foot peddle, slip the bed pan and its contents into the sterilizer and close the top. Press the hand lever to start the hot water and steam spray. The bed pan is removed from the sterilizer in 15 to 30 minutes time, and placed in a warming cabinet or on the rack. Where bed pan sterilizers are not available, wash out the pan first with cold water and then scrub with hot, soapy water and a brush. If the patient has had mineral oil, it will be necessary to use plenty of

"elbow grease" in addition to the above. If the pan is to be used by more than one patient, it is placed in boiling water for 15 minutes to sterilize. If unable to sterilize by boiling, place pan in a chemical antiseptic such as 5% cresol or lysol, 2% formalin, or 1-1000 mercury bichloride solution for 1/2 hour. If the patient has a communicable disease such as typhoid fever, it is necessary to decontaminate the stool before emptying the bed pan. Break up the feces with a tongue depressor and cover with chlorinated lime. Let stand for 1 hour before flushing the feces into the sewage system.

After removing the pan from the bed side, remove the screens and air out the room well. If the patient cleaned his own anus, give him a basin of hot water, soap and a towel, so that he may wash his hands at once. If you cleaned the patient's anus, it is not necessary to do the above, but when you have finished with the bed pan, wash your own hands with hot water, soap and a brush. You are now ready to record on the patient's chart the fact that he has had a bowel movement. This is done by recording the time, the amount, the appearance and consistency of the feces.

X. URINAL

The urinal is a glass or metal container designed to receive the urine from a bed patient. Patients commonly call them "ducks". The urinal is brought to the bed side covered with a cloth. It is placed between the patient's legs and the patient's penis placed into it. After voiding, note the color, odor and the amount of the urine. After the urinal is emptied it is cleaned by first rinsing with cold water and then hot water. If the urinal is used by more than one patient it must be sterilized after it is cleaned. Containers that have had body discharges in them (urine, feces, blood, pus, etc.) are always washed with cold water first. All body discharges contain protein. This protein is best removed with cold water. If hot water is first used, the protein is caused to stick to the walls of the container and is very difficult to remove.

After disposing of the specimen and washing your hands, record in the patient's chart the time of voiding, the amount and appearance of the urine. A small amount of blood gives urine a smoky appearance. A large amount of blood causes the urine to appear red.

Never leave a bedpan or urinal on the floor by the patient's bed, even if it is clean.

XI. COLLECTION OF SPECIMENS

A. You should know how to collect the following specimens:

1. Sputum	4. Vomitus
2. Urine	5. Blood
3. Stool	6. Smears

B. Instructions:

1. Keep all the specimens in a cool place that are not sent to the laboratory at once.
2. Wash your hands well after collecting and handling all specimens. At Brooke General Hospital all specimens are marked in the following manner: each specimen is given a number which is recorded on the specimen bottle with a red wax pencil. Two specimen slips are filled out for each specimen and same number placed on the two slips with red wax pencil as was placed on the bottle. All three items are sent to the laboratory. After the specimen is examined, and the specimen slips completed, one is filed in the laboratory and the other is sent back to the ward to be pasted in the patient's chart. A sterile specimen is one collected so that no outside germs gain access to it. Thus, it must be collected in a sterile bottle, with sterile technique. A specimen may contain many deadly germs and yet it is called a "sterile specimen". These germs came from the patient's body.

C. Sputum - is material that comes from the lungs. It is not saliva (mouth fluid). Sputum specimens are always collected with sterile technique so that no outside germs get into them, and are therefore, "sterile specimen". The patient is told to cough up sputum from "deep down" in the lungs, and to clear the sputum from the back of his throat directly into a small, wide-mouth, sterile glass jar, without touching the mouth of the bottle with his lips. The bottle is then covered with a sterile gauze or cork. Try to get at least one teaspoonful of sputum for the specimen.

D. Urine

1. The urine is passed directly into a clean urine bottle. Collect at least four ounces (120 cc.). If he can only void a few cc., collect what you can and send to the laboratory. If the patient is a bed patient, to avoid soiling the sheets, you may have to collect the specimen in a clean urinal and transfer it to the bottle.
2. If a sterile urine specimen is ordered, it is collected by passing sterile catheter into the patient's bladder, and permitting the urine to flow into a sterile urine specimen bottle. The bottle is covered with a sterile gauze or cork and sent at once to the laboratory.

3. If a "24 hour urine specimen" is to be collected, use a large clean jar and keep it in a cool place during the 24 hour period. Select the 24 hour period to suit yourself. It is best to start at 8:00 A.M. and collect the specimen until the same time the following day. The idea is to collect all urine produced by the kidneys during this 24 hour period. The patient voids at the start (8:00 A.M. today) and this urine is discarded, thus starting with an empty bladder. All urine passed for the next 24 hours (up to and including 8:00 A.M. tomorrow) is saved in the large jar. The last specimen is collected exactly 24 hours after the start. The whole specimen is sent to the laboratory. Formalin (2% to 5%) is added to urine specimens as a preservative. 10 to 15 drops is sufficient for a large jar. Chloroform may be used as a substitute for formalin.

E. Stool or Feces - a mass of stool about half as big as your thumb is picked up from the bed pan with a clean tongue depressor and deposited into a clean, small, wide-mouth, glass jar. The sputum jar is covered with gauze or cork and sent to the laboratory properly labeled.

F. Vomitus - vomitus is transferred from the basin in which the patient has vomited, to a clean wide-mouth glass jar (urine specimen bottle). Cover the jar with gauze or cork, label properly, and send to the laboratory. Collect 120 cc. if possible.

G. Blood - there are three main ways to collect blood specimens:

1. In the first method a test tube of blood is collected for such tests as the Wassermann or Kahn tests. The skin of the anterior surface of the elbow is sterilized with iodine and alcohol. A tourniquet is placed about the arm above the elbow. A sterile needle is inserted into a vein and the test tube held at the hub of the needle to collect the blood. Often a 10 cc. syringe is attached to the needle and the blood drawn into the syringe, and then transferred to the test tube. Usually about 10 cc. of blood is collected. This blood will clot in the test tube.

2. In the second method blood is collected so that it will not clot. Blood kept in a liquid form is necessary for many tests such as blood sugar determinations. Ten (10) cc. of blood is collected in a syringe and transferred to a small glass bottle that contains a few crystals of an oxalate or citrate to keep the blood from clotting.

3. The third method is the blood smear. The tip of the middle finger or ear lobe is wiped off with alcohol and stabbed with a hypodermic needle so that a drop of blood appears on the skin surface. One end of the flat surface of a glass slide is touched to the drop so that the blood is transferred to the slide. The edge of another glass slide, held at a 45 degree angle to the first one, is placed in the drop of blood. Then the top slide is drawn across the bottom thus smearing the drop of blood over the flat surface of the bottom slide. After standing a few minutes, the blood will dry, and it then can be stained with dyes, and examined under a microscope.

H. Smears - smears are made of blood, pus or other body fluids or discharges. To make a smear of pus a sterile cotton swab is dipped into the pus so that the pus moistens the cotton. Then the moistened swab is drawn across the flat surface of a clean glass slide, smearing a thin layer of the pus on the glass surface. After drying for a few minutes, the smears can be stained with dyes and examined with a microscope.

XII. THE DYING PATIENT

Dying patients should be moved to a separate room. If this is not practical, surround the bed with screens, so that other patients will not see the dying person.

A. Symptoms of Death:

1. Absence of breathing - if you see no movement of the patient's chest, place your hand lightly on the chest to feel for a possible slight movement.
2. Absence of Heart Beat - place your ear to the left side of the patient's sternum (against his skin) and listen. It is best to use a stethoscope, placing the bell between two ribs to the left of the patient's sternum.
3. Absence of Pulse - feel for the pulse at the wrist with the tips of your forefinger and middle finger.
4. Dilatation of Pupil - (saucer pupil) - by the pupil is meant the black hole in the center of the eye. The "iris" is the colored muscle curtain that surrounds the pupil. In death the pupil is surrounded by a very narrow rim of colored iris. If the patient is still alive, when a light is flashed into his eye, the colored curtain (iris) will contract down, and make a much smaller pupil. If any change at all occurs in the size of the pupil when the light is flashed into the eye, the patient is alive. If there is no change in the dilated pupil, that patient is dead.
5. Later, the body becomes cold, rigor mortis sets in, the eyeball becomes very soft, and finally the body begins to decompose.

B. Care of the Body

After death has occurred, the body is bathed and wrapped in a clean sheet. It is then placed in the morgue refrigerator. To prevent the soiling of the skin surfaces by fluids from the various body cavities (i.e., mouth, nares, rectum), all openings are plugged with cotton. A large piece of cotton is tied about the penis with roller bandage to catch any urine that might spill from the bladder.

In the morgue, the legs are straightened out and the ankles tied together with roller bandage. The jaw is tied up with roller bandage or a 4-tailed bandage so that the mouth is closed. The arms are straightened out, and the wrists tied together over the abdomen.

XIII. ADMINISTRATION OF MEDICINES

There are nine ways frequently used to administer medicine:

Cutaneously - by applying to skin surface.
Orally - swallowed by mouth.
Rectally - placed into the rectum.
Intra-nasally - placed into the nose.
Subcutaneously - injected under the skin (hypodermically).
Intravenously - injected into a vein.
Inhalations - inhale into the lungs.
Intramuscularly - injected into a muscle.
Intradermally - injected into the skin.

A. Cutaneous Route

There are many drugs used for healing skin conditions applied cutaneously, but these will not be discussed.

1. To sterilize skin:
   a. Scrub well with hot water and soap, and dry.
   b. Paint with Tincture of Iodine, full strength (7%), or half strength (3 1/2%).
   c. Remove the Tincture of Iodine with 70% alcohol, to prevent blistering of the skin.

B. Oral Route

1. Take great care to avoid mistakes. Compare the label of the bottle with the order written in the order book to be sure you have the correct medicine and correct dose.
2. Carefully measure your dose from the bottle.
3. Use a "graduate" to measure liquid medicines.
4. Pour the medicine from the bottle on the side opposite the label.
5. Use a medicine glass to carry the medicine to the patient's bed side.
6. Watch the patient take the medicine. Medicine should NEVER be left with the patient to be taken by himself.
7. All medicines are given well diluted with water and followed by water to increase their absorption, unless the medical officer orders otherwise. Cough medicine is the one exception to this rule. Have the patient drink freely before taking the cough mixture and do not let him drink for at least a half hour after taking the mixture.
8. Record in the patient's chart the time, the name of the medicine and the dose given. (Never make this record before giving the medicine).
9. Before giving a drug with a disagreeable taste, let the patient hold ice chips in his mouth to anesthetize the taste buds of his tongue.

10. Never awaken a sleeping patient for medicine unless the order is written in such a manner that you have no choice in the matter: q.2.h., q.6.h., ac, pc, stat, and hs are all examples of ways in which the order could be written, so that you would have to awaken a sleeping patient to administer medicine.
11. The best way to give castor oil is to put the dose in a half glass of orange juice. At the patient's bedside add a quarter or half teaspoonful of baking soda (sodium bicarbonate). Administer while fizzing.
12. Powders, if small, are placed on the back of the tongue and washed down with water. If large, stir in a glass of water and swallow before it settles in the glass.

C. Subcutaneous Route: a subcutaneous injection is the introduction of fluid underneath the skin.

1. Hypodermic Injection.
   a. The hypodermic syringe (2 cc. capacity) is sterilized by boiling in water for 20 minutes. It is kept sterile by removing from the water with sterile forceps and immersing in a jar of 70% alcohol till needed. A hypodermic needle (1/4" to 1/2" long and about 25 gauge) is placed in a tablespoonful of distilled water after removing the stilette. An alcohol lamp is used to heat the spoon until the water has boiled for one to three minutes. Stop before all the water boils away. The needle is now considered sterile and is removed from the water with sterile forceps and placed on a dry sterile sponge or alcohol sponge until ready for use.
   b. The syringe is removed from the jar of alcohol with a sterile forceps, and the plunger inserted into the barrel, taking care not to contaminate the plunger or the tip of the barrel. Work the plunger up and down several times to expel the alcohol inside the barrel. Wash out the barrel with a half cc. of sterile water from tablespoon. Discard this wash water and fill the syringe with 1 cc. of water from the spoon. Any remaining water in the spoon is discarded, and the 1 cc. in the syringe is expelled back into the spoon. The proper number of tablets to make up the dose ordered is dropped from the bottle into the spoon, using the cork to prevent extra tablets from spilling out.
   c. By filling the syringe and expelling the water from it, the drug goes into solution readily. Every drop of the liquid is drawn into the syringe, the needle attached by means of a sterile forceps, and an alcohol sponge is used to protect the needle until ready for injection. Air is expelled by advancing the plunger with the needle up, until a drop of solution appears at its tip.

d. The best site for injection is the outer rear surface of the upper arm. The skin is cleansed by the alcohol sponge applied with a spiral motion beginning at the site of injection and progressing outward until an area of about three inches has been prepared. Pick up the soft tissues between left thumb and forefinger, and with the bevel up, the needle is quickly inserted under the skin in a direction almost parallel to the skin surface (45 degree angle). The solution is injected, the needle withdrawn, and the injection site massaged with the alcohol sponge.

e. Rinse out the syringe and needle with tap water, dry by sucking air into the syringe and expelling with the plunger. Insert wire stilette into needle and replace on the tray. The plunger and barrel are fastened together with a rubber band, sterilized by boiling, and then replaced in the jar of 70% alcohol, handling with sterile forceps.

f. It is best to tell the patient what to expect before you insert the needle, so that he will not jump and break the needle. It is very important to draw into the syringe every drop of the solution in the spoon in which the drug has been dissolved. It is also important to lose as little of the solution as possible when expelling air from the syringe, and to inject all of the solution under the patient's skin, so that the complete dose has been given. Before sterilizing needle, check it for a "Burr". This is a bent point. If you think the inserted needle is in a blood vessel, partially withdraw and reinsert.

2. The Administration of Morphine Sulfate. - Probably the most frequently administered drug by the above method is Morphine Sulfate. It is important that you know the following symptoms, to determine when it is safe to administer H.M.S.

a. Symptoms that indicate morphine sulfate:
   (1) Severe pain.
   (2) Marked restlessness.

b. Symptoms that contraindicate morphine sulfate:
   (1) Slow respiratory rate (less than 12 to 14 times per minute).
   (2) Contracted pupil (pin point).
   (3) Drowsiness, deep sleep or coma.

3. The Hypodermoclysis - this is the subcutaneous injection of a large amount of fluid (usually 1000 cc.). The fluid is allowed to flow from a reservoir through a rubber tube and two needles into the subcutaneous connective tissue of the lower lateral chest wall or the medial aspect of the thighs. The tissues are gently massaged to spread the fluid out over a greater surface and so increase the rate of absorption. By injecting the fluid in two sites (usually 500 cc. in each site), a liter can usually be given in an hour's time.

   a. The fluids most frequently used are:
      (1) Normal Saline (.85% solution of table salt in sterile water).
      (2) Glucose (never over 5% solution in sterile water or saline).
      (3) 8 gm. of sulfanilamide in 1000 cc. of saline to make an .8% solution. The medical officer will order this given in divided doses.

   b. After preparing the skin at the site of injection with an antiseptic, the site is draped with sterile towels, exposing only the prepared areas. Take up the sterile apparatus, so as not to contaminate the opening to the reservoir or the needles, and pour some of the sterile solution into the reservoir with sterile precautions. Air is expelled from the tubing by the solution. The rubber tube is clamped to prevent escape of the fluid. The needles are inserted into the prepared areas, covered with sterile gauze, and held in position with strips of adhesive. The clamp is removed so that the solution will flow. The tips of the needles lie in the loose subcutaneous tissue. The fluid is placed in the reservoirs at a temperature of 110°F., so that after passing through the rubber tubing, it reaches the tissue at body temperature. The temperature of the solution is maintained by surrounding the reservoir with hot water bottles. In some hospitals, no effort is made to keep the solution warmed above body temperature. A sterile cover should be draped over the top of the reservoir, and full aseptic precautions observed each time the solution is replenished. The reservoir hangs about two feet above the site of injection. Watch the site of injection. If the area is blanched, firm to touch, and painful, the flow must be shut off by clamping the rubber tubing, and the area gently massaged to spread out, and so hasten the absorption of the fluid. Then the clamp may be removed, and the flow again started.

D. Intravenous Route.

1. The Intravenous Infusion ("Venoclysis", "Intravenous", "I.V."): this is the injection of a large amount of fluid into a vein. The amount is usually 1000 cc.

   a. The solutions most frequently used are:

      (1) Normal Saline (.85% solution of salt in sterile water).

      (2) Glucose Solution (5% to 50% solutions in sterile water).

      (3) Normal saline and 5% glucose combined.

      (4) Blood (whole) and Plasma.

   b. The arm to be used is loosely splinted to a padded board with 3 inch roller bandage applied well above and below the elbow. Take care not to put this roller bandage on so tight that it acts as a tourniquet. A rubber tourniquet is placed underneath the upper arm but not tied. The anterior elbow surface is prepared with an antiseptic on a sterile cotton ball or gauze pledget held in a sterile forceps. Drape the area with two sterile towels leaving the prepared area exposed. The sterile cap from the warm (110°F.) flask of solution is removed and the rubber tubing and sterile needle attached to the bottle with sterile precautions. If a burette is to be used, the warm sterile solution is poured into it with sterile technique, and the open top of the burette covered with a sterile piece of gauze (4" x 4"). The flask or burette is hung on a standard along side the arm, at the desired height (usually about 2 feet above the level of the elbow), and the air expelled from the tubing and needle. The rubber tubing is now clamped so that the fluid cannot flow. The tourniquet is tightened, so that the elbow veins distend with blood and the needle inserted with the bevel up into the lumen of a vein. As soon as the needle enters the vein, the dark blood can be seen passing back into the rubber tubing. When this happens, you know the needle is in proper position. The tourniquet on the upper arm and the clamp on the rubber tubing are released. The needle is propped up by means of a small piece of sterile gauze under its hub, and fastened in place by a strip of adhesive tape over the hub. The needle usually used is a 20 gauge needle, 1 1/2" to 2" long. About 20 minutes is taken to give 500 cc. of fluid. In shock a liter of the fluid may be given in a half hour's time.

c. The technician must not leave the patient's side while the treatment is being given. He must make and record frequent observations of the pulse, respiration and color. If a burette is used, it is replenished with sterile technique so that it does not become empty, thus permitting air to enter the vein. The rate of flow must be observed and regulated as ordered by the medical officer. A Hoffman clamp on the rubber tubing makes an easy way to control the rate of flow. The height the burette or flask hangs above the arm also controls the rate of flow. Watch the site of injection closely, and if a collection of the fluid is noted at the needle's point in the subcutaneous tissue, shut off the flow, and call the medical officer to reinsert the needle in the vein. At the end of the treatment, take care to clamp off the flow before all of the fluid runs into the vein, so as to prevent the entry of air into the blood stream.

2. <u>The Continuous Intravenous Infusion</u> (Intravenous Drip). In this treatment the intravenous infusion is set up so that the fluid flows into the patient's vein drop by drop over a long period of time (one or more days). The solution is usually given at a rate of about 150 cc. per hour (about 35 to 40 drops per minute). This rate can be greatly increased if so ordered by the medical officer. The apparatus is as described for the regular intravenous infusion, with the addition of a Murphy bulb (drip bulb, drop bulb) between the flask and the needle. This is a glass bulb so constructed that the fluid flows through it drop by drop. The rate of flow of the drops can be controlled by a Hoffman clamp on the rubber tubing above the Murphy bulb.

3. <u>The Blood Transfusion</u> - this is a special form of "Intravenous Infusion". The following method is called the "Citrate" or "Indirect" method of blood transfusion. The anti-coagulant used is Sodium Citrate (2.5% solution). The blood is taken from the donor through a large caliber needle (15 gauge) into a flask containing 50 cc. of 2 1/2% Sodium Citrate Solution. Meanwhile, the recipient has had a regular intravenous infusion started with about 100 cc. normal saline. The needle used in the recipient's arm is also one of large caliber (probably 4 or 5 times as large as the regular intravenous needle). The citrated blood, which has been kept warm by gentle agitation in a basin of water at 110°F., is added to the burette partially filled with the normal saline flowing into the patient's vein. In cleaning the apparatus at the end of the transfusion, great care must be taken to carefully wash in cold water all articles used. Force cold water through the needles and through the rubber tubing, as soon as the treatment is finished.

E. <u>The Intramuscular Route</u> - In this route the needle is placed deep in the muscle of the buttock with a stab-like motion. The needle used is 2 1/2 to 3 inches long. The longer (3") is the better. The site of injection is always in the upper-outer quadrant of the buttock. After sterilizing the skin, the needle is stabbed into this area to the hub and a syringe attached. Suction is applied by pulling back on the plunger. If any blood appears in the syringe, pull the needle out half way or so, change its direction, and reinsert in a new site. Since there are many large blood vessels deep in the buttock muscles, always check in the above manner, so as not to inject the medication into a vein. After injecting the solution ordered, pull the needle out with a quick pull, and massage the site of injection with the alcohol sponge. This route of administration is used only occasionally. Its main use is for the administration of medicines containing Bismuth (a heavy metal used in the treatment of most cases of Syphilis).

F. <u>The Inhalation Route</u>: Drugs such as Ether, Chloroform, Oxygen are given in this manner. The Steam Inhalation is a method of treatment for inflammation in any part of the respiratory tract.

The treatment is carried out by placing about 1 liter of water in a shallow pan, and boiling the water. The patient holds his head over the pan to inhale the fumes. There are many drugs that can be added to the water to add to the effect of the steam. Of these, Compound Tincture of Benzoin is the most important. Add about 1 ounce (30 cc.) to each liter of boiling water. The medical officer's order will always state how often to give the steam inhalation and how long to continue each treatment. By throwing a sheet over the patient's head and the boiling water, the fumes will be concentrated and make for a more efficient treatment.

G. <u>The Rectal Route</u>

1. <u>Suppositories</u> - are bullet-shaped objects made of medicine in cocoa butter, designed for rectal administration of medications. The tin-foil or paper wrapping is removed, the suppository lubricated with water or mineral oil and inserted into the anus, pointed end first. The body heat melts the cocoa butter, and so liberates the drug, which can now come in contact with the lining membrane of the rectum.
2. <u>Enemas</u> - an enema is the placing of fluid into the rectum.

a. There are two main types:

(1) <u>Evacuating</u> <u>Enemas</u> - given to clean out the lower large bowel.

In giving the Evacuating Enema, protect the mattress with a rubber sheet. Place the patient on the edge of the bed on his left side, for the rectum lies to the left side of the pelvis, and the enema fluid will run downhill better than uphill. If it is impossible to place the patient on his left side, give the enema in the dorsal recumbent position, (that is, flat on his back with knees drawn up). Unless it is impossible for the patient to retain the fluid, the bed pan should not be placed under the patient until after the injection of the entire amount of fluid. The apparatus is assembled, consisting of the enema can connected to a rectal tube. One to two liters of enema fluid is placed in the enema can, and the air expelled from the tubing and rectal tube. Lubricate the end of the rectal tube with mineral oil or lubricating jelly, and insert the tube just into the anus. Permit a small amount of enema fluid to run in and then insert the tube in for a total of three to six inches. The can is held about 2 feet above the level of the anus. Run the 1 to 2 liters of enema fluid into the rectum slowly. Take at least 5 minutes. A larger amount can be given and retained by the slow injection. If discomfort occurs (i.e., pain or cramps in the lower abdomen), stop the flow momentarily and then continue. After the fluid has been given, the tube is pinched and slowly withdrawn. It is now desirable for the patient to retain the enema fluid for 5 to 10 minutes, if possible. The technician can assist the patient to retain the enema by pressing the two buttocks together. The patient can assist in holding the enema by bending his knees towards his chest, taking deep breaths through his mouth, and tightening his own muscles to attempt to hold it.

When ready to have the patient expell the enema, let him use the latrine, if possible. If he is not permitted out of bed, put the bed pan under the patient, and prop him up in a semi-sitting position, or if permitted, sit the patient up on the bed pan.

If the patient is able to clean his anus, hand him a roll of toilet tissue. If the patient is so weak that he is unable to accomplish this by himself, the technician will clean the perineum. If necessary, soap, water and wash cloth may be used after the tissue.

The enema produces its results largely by stimulating peristalsis. The injected fluid distends the rectum. The stretching of the large bowel produces a very active, wave-like movement of the muscle wall known as "Peristalsis". This muscle movement serves to expel the enema and the stool (feces) in the lower large intestine.

Often irritants are added to the enema to produce very active peristalsis. The one most frequently used is soap. The enema is called the "Soap Suds Enema". Enough mild soap as Ivory or Castile is dissolved in hot water to make a soapy solution. Never use laundry soap for it is too irritating. Other irritants added are: Turpentine - 1 to 4 drams to the enema; Glycerine - 2 to 4 ounces to the enema. Inspect the contents of the bed pan for blood, pus, mucus, parasites, amount and color of the feces, etc. Following the enema, clean all apparatus and record the results. State on the chart the time, amount and type of enema given, and results produced.

When the patient is unable to expell the enema, if only one liter of fluid has been given, inject a second liter into the rectum. If this is not successful, it may be necessary to siphon off the enema fluid by inserting a rectal tube into the rectum. In most cases no harm is done if the patient should be unable to expel a plain water enema, but if an irritant has been added to the fluid, it is important that the enema fluid be expelled or siphoned from the bowel.

(2) <u>Retention Enema</u> - the retention enema is carried out in a manner similar to the evacuating enema with these main differences:

(a) Only a small amount of fluid can be injected (100 cc. to 200 cc.). A larger amount will cause distention of the bowel wall and thus peristalsis and expulsion of the fluid.

(b) The enema must be injected very slowly. Take 10 minutes to inject the 100 cc. of fluid so as not to produce distention and peristalsis.

(c) A small rubber tube (16 F. catheter) is used in place of the large rectal tube; for the large rectal tube, by stretching the anus sphincter muscle open, stimulates peristalsis.

(d) Every effort is made to have the patient hold the enema and not expel it.

If the patient has not had a bowel movement in the six to eight hours previous, it is best to precede the retention enema by an evacuating enema. Following this, wait one hour for the peristalsis to quiet down before injecting the retention enema. All retention enemas should be held at least one hour, to be reasonably sure that the drug or food present was absorbed. Often the addition of starch to the enema fluid to make it thicker will assist the patient in holding his retention enema. Starch water being thicker than plain water, it is less likely to ooze out of the anus.

3. Proctoclysis (Murphy Drip)

Water introduced into the rectum in quantities not large enough to distend the bowel, is absorbed and so added to the blood. The aim is to introduce a small amount of fluid slowly into the rectum. By this method 2 to 3 liters may be given in a 24 hour period. The apparatus used consists of the enema can attached to a small (16 F) catheter by rubber tubing. The tube leading to the catheter is fitted with a Murphy bulb (drip bulb or drop bulb) so that the fluid will flow drop by drop. A Hoffman clamp on the tubing above the Murphy bulb controls the rate of flow. The solution used (it does not have to be sterile) is placed in the enema can at a temperature of 110°F. Permit the fluid to expel the air from the apparatus. Insert the catheter from four to six inches into the rectum and fasten in place by adhesive straps to the buttock. The flow is best given at the rate of 500 cc. per hour. Permit the flow for one hour, then close the Hoffman clamp so there is no flow for the following hour. Continue in this manner of an hour on and an hour off. A cleansing enema should always precede the administration of proctoclysis. The solutions most frequently used are:

a. Tap water
b. Normal Saline (Physiological salt solution -.85% solution of $NaCl$ in H_2O).
c. 5% Glucose Solution.

XIV. GASTRIC LAVAGE AND GAVAGE

A. Definition: Lavage - means to wash out or irrigate.
Gavage - means to feed through a tube.

1. Gastric Lavage (nasal method) is a procedure frequently carried out on the wards. A "Duodenal" or "Levine" tube is used. The tube is passed through the patient's nose, into his throat and thus into the esophagus and stomach. Through the tube, the stomach cavity can be lavaged, or food placed into it (gavage). The duodenal tube is 4 feet long and 14 F. in caliber. The blunt end, which is inserted into the patient's nose, has 4 openings. About 18 inches from the blunt end is a black ring around the tube. When the tube is inserted so that this black ring is at the skin margin of the nose, the blunt end is at the junction of the esophagus and the stomach. Four inches beyond the first black ring is a second ring. When the tube is inserted so that this ring is at the entrance to the nose, the blunt end is well into the stomach lumen. Four inches beyond the second ring is a third, and finally a fourth. If the tube is inserted to the third black ring, the blunt end of the tube is just beyond the stomach in the small intestine. The first part of the small intestine is called the "Duodenum". Thus does this tube get its name, for in most cases when the tube is inserted, it is placed into the lumen of the duodenum. When the tube is inserted to the fourth and last black mark, the blunt end is several inches into the duodenum.

The Duodenal Tube is well lubricated with lubricating jelly. It is inserted along the floor of the nose about 3 inches. If trouble is encountered, try the other side of the nose, for often one side of the nose may be obstructed by a crooked septum. When the tube is in position, give the patient a glass of water to drink through a glass drinking tube. As he drinks, push the tube into his nose. The tube and water will both pass from the back of the throat into the esophagus and thus into the stomach. Once the tube is in place, the patient can breathe, talk, eat, etc., without any trouble. The tube is held in place by strapping with adhesive to the skin of the cheek.

Since this tube is very small, it is possible for it to enter the trachea and lungs. This is a very rare occurrance. Always check, to be sure that you are in the stomach before injecting any fluid into the tube. If fluid should be injected into the lung, a lung abscess or pneumonia would develop.

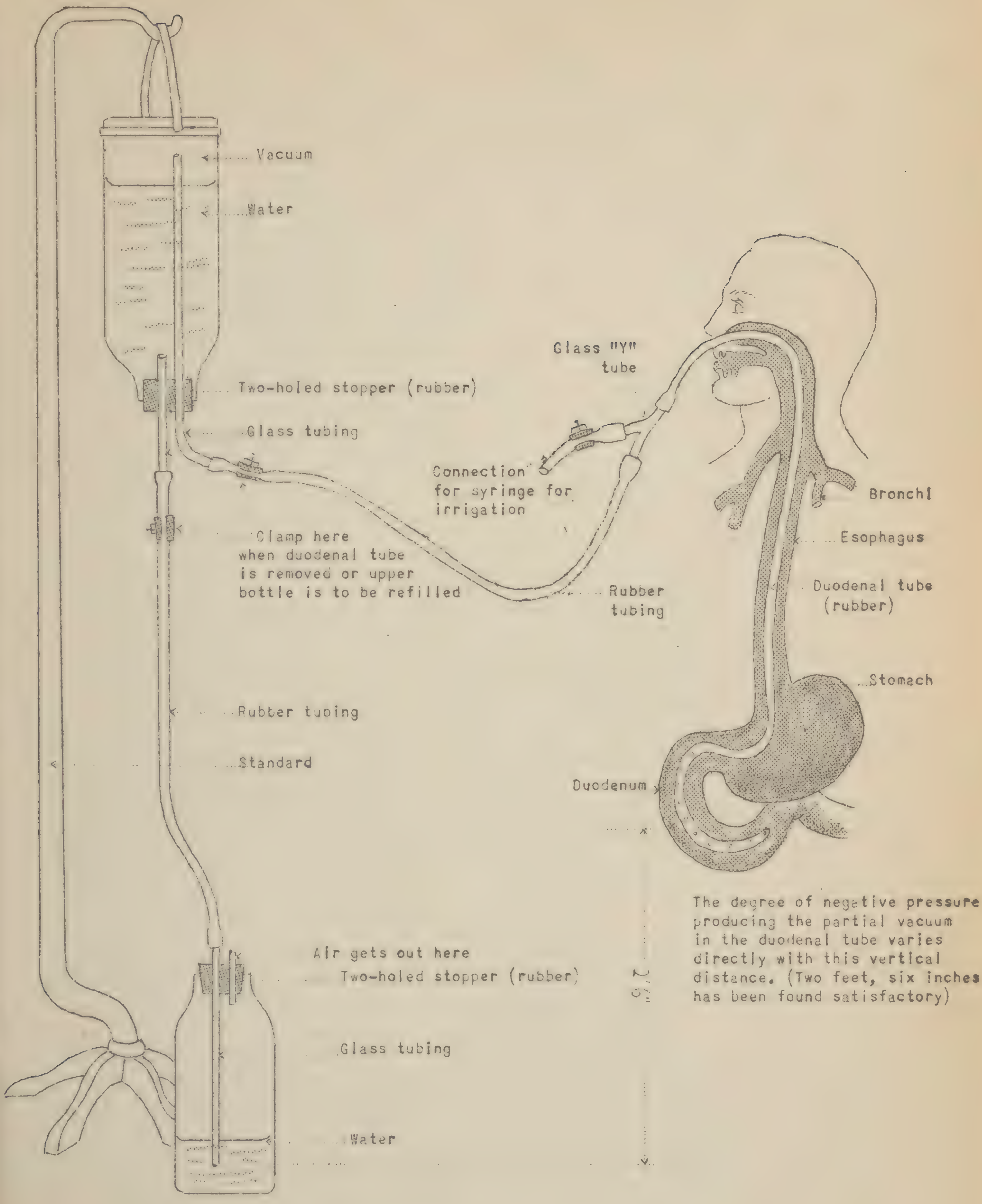
a. Hold the end to your ear and listen. You will hear a whistling sound with each breath if the tube is in the lungs. If in the stomach, you will hear either nothing or a gurgling sound as stomach peristalsis churns the gastric fluids.
b. When the tube enters the trachea, the patient may cough or turn cyanotic. These are not reliable symptoms, for the tube can enter the lung without their occurrence.
c. With a syringe, suck back on the tube. If in the lungs, the syringe will fill with air. If in the stomach, the syringe will fill with gastric fluid. With the tube in the stomach, the patient can be fed liquids through tube (gavage), or the stomach may be washed out (lavage).
d. To get the blunt end of the tube to enter the duodenum, the tube is inserted to the first black mark. Then it is advanced 1/2 to 1 inch every 10 minutes, until the tube has been inserted beyond the third black ring. The blunt end should then be well into the duodenum. If the tube is placed down to the third or fourth mark all at one time, it will coil up in the stomach and never get into the small intestine. Often, inserting the tube an inch every 10 minutes, the tube will coil up into a ball in the stomach. Therefore, the following test is made to determine just where the blunt end of the tube lies. Fluid is aspirated and tested with blue "Litmus Paper". If the fluid turns the blue colored litmus paper to a red color, then the fluid is acid, and the end of the tube lies in the stomach cavity. The hydrochloric acid secreted by the stomach lining makes the gastric fluid acid in reaction. If the aspirated fluid has no effect on the color of the blue litmus paper, you can assume that the fluid is alkaline (basic), and therefore, came from the small intestine (duodenum). The fluid in the small intestine is alkaline (basic) from the bile. Better yet, get some RED litmus paper, and if the end of the tube is in the duodenum, the alkaline fluid from the small intestine will turn the red litmus paper to a blue color.

"Acids turn Blue Litmus Red".

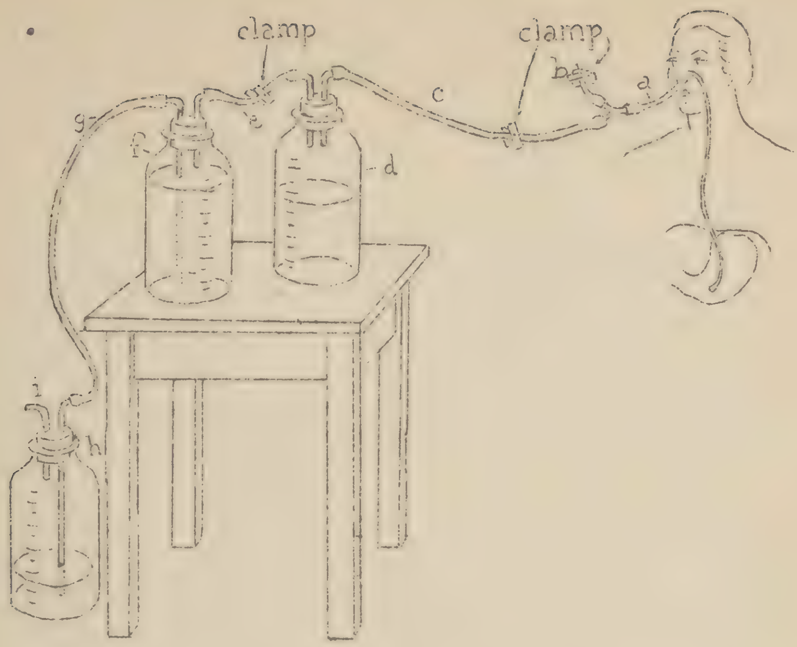
"Bases turn Red Litmus Blue".

2. The Duodenal Decompression or Wangensteen Suction Apparatus.

Where it is desirable to decompress (empty) the small intestine of gas, fluid and toxic material present, it is best accomplished by means of the duodenal tube, and the apparatus diagramed (Wangensteen Suction). This apparatus may be set up and kept operating for several days. It requires constant attention to keep the narrow lumen of the duodenal tube from plugging with thick mucus or food particles. When such an apparatus is in place, do not permit



WANGENSTEEN SUCTION APPARATUS



NEW AND SIMPLE TYPE OF BOTTLE ARRANGEMENT FOR GASTRIC AND DUODENAL SUCTION DRAINAGE (GERLINGER). Bottle (d) is the trap bottle, and suction is created by siphonage from bottle (f) on the table to bottle (h) on the floor. To start the siphoning, the clamp on tube (c) is closed and the rubber tube (e) is disconnected from the short glass tube on bottle (f). By blowing into this short glass tube, siphon drainage is started and tube (e) is again connected. When bottle (f) becomes empty, it is simply replaced by bottle (h), which is now full, and after blowing into tube (i) to begin the siphonage, tube (e) is attached and suction drainage is continued. If the exchange between bottles (f) and (h) is made before the water level in bottle (f) gets below the level in the long glass tube, the siphonage already established will be maintained and will not have to be restarted. During the exchange of bottles (f) and (h), the clamp on tube (c) is closed.

the patient milk, ice-cream or unstrained fruit juices, for the milk curds and fruit pulp easily plug the lumen of the small tube. The short arm of the glass "Y" tube is for the attachment of a syringe of tap water for irrigating purposes. As soon as the water flows from the top bottle to the bottom bottle, the top bottle must be refilled, so as to maintain constant suction.

3. Gastric Lavage (oral method) - means the washing out of the stomach. The regular gastric tube is used. This tube is size 30 F. (1/2" outside diameter). One end is blunt-pointed and is inserted through the mouth, throat and esophagus into the stomach cavity. It is marked with a white ring 18 inches from the end. The other end has a funnel attached.

The lavage is best given in a sitting position, but if necessary it can be done with the patient flat on his back. Protect the patient and bed with a rubber sheet over the patient. Have a large slop basin at the bedside to receive the lavage fluid. The gastric tube is chilled by placing in ice water or ice chips before passing. The irrigating fluid will always be specified by the medical officer. It is usually plain tap water (at body temperature - 100°F.), or water to which bicarbonate of soda has been added (ʒi to the liter). The amount of fluid used varies. The lavage should be continued till the irrigating fluid returns with an appearance exactly as when it was poured into the funnel. Thus it is best to have at the bedside about 2 gallons of fluid, although in most cases one gallon is sufficient to do a good lavage. Before starting, place an emesis basin in the patient's hands, for many will vomit while the tube is passed or immediately afterwards. If vomiting does occur, there is no occasion for alarm because this partially empties the stomach cavity, and thus less lavaging will be necessary to finish the job. Should the patient be intoxicated by alcohol or otherwise uncooperative, it may be necessary to hold him in restraint while doing the lavage. Since this type of patient can easily bitethe gastric tube, it is necessary to use some type of mouth gag. A simple way to prevent the patient from biting the tube is to put 8 or 10 tongue depressors together, and place them between molars on one side of his mouth, so holding his jaws apart.

Before passing the tube, tell the patient what you are going to do, and explain to him that as the tube is passed (which takes but 5 seconds or less) he will have trouble catching his breath, but that as soon as it is down, he can breathe normally.

When ready to pass the chilled tube, have the patient open his mouth, and take deep breaths. This will relax the patient. Usually when a patient is told to open his mouth, he does so, as widely as possible. This partially closes off the throat passageway to the esophagus; so be sure that the mouth is open about half way. Instruct the patient to stop taking deep breaths when you place the tube in his mouth, and to"swallow his Adam's Apple". The tube is inserted, aimed along

the roof of the mouth. The curvature of the roof of the mouth will carry it into the esophagus. Insert the tube until the white ring is at the patient's lips. You can then be sure that the blunt end of the tube is 2 to 3 inches into the stomach of the average man.

The tube in position, you are now ready to lavage the stomach. Lower the funnel end of the tube to the slop jar on the floor, to permit any fluid in the stomach to drain out. Often the presence of the tube will set up violent reverse peristalsis and the fluid will be forced out of the funnel with considerable force. Pour about one pint of lavaging fluid into the stomach, and before it all runs out of the funnel, pinch off the tube just below the funnel. When the funnel is lowered to the slop jar (to a point below the level of the stomach) siphonage is set in action to recover the fluid from the stomach. This process is repeated several times, till the lavaging fluid returns clear. During the time the gastric tube is in place, the patient may retch, and even vomit. This cannot be helped, so proceed with the lavage. When you have the patient's full cooperation, you can let him hold the gastric tube near his lips. He will be able to hold it so that it does not make pressure on his tongue or the rear of his throat. This will reduce the desire to vomit.

XV.. PHYSICAL AGENTS USED IN NURSING

A. Heat - If heat is applied to an area of the body, the capillaries in that area are dilated open, and the blood flow is greatly increased to the area. Thus, heat produces an increased blood flow into the area and an increase in the blood flow out of the area. Since the healing of inflammation depends on the flow of blood to the inflammed area, wide use is made of heat to bring about that increase. Dry heat (hot water bottle or lamp) is good. Wet heat (wet dressings or soaks) is better.

1. Methods for Use of Wet Heat

a. Hot Compress - hot compresses are pieces of cloth dipped into a hot solution and applied to the inflammed area. As soon as the cloth has lost its heat, it is redipped into the hot solution and reapplied to the inflammed area. When a medical officer orders hot compresses applied to some part of the patient's body, he will always state the name and strength of the solution to be used, how long each application of compresses shall last, and how often to repeat the treatment.

Let us assume we have a patient with a large boil on the back of his neck. The medical officer has written the following order: Hot compresses of sat. sol. of $MgSO_4$ for 1 hour q.2.h. to inflammed area of posterior cervical region. To carry out this order, get a basin large enough to hold a liter of solution. Boil this for 20 minutes so that it is sterile. Place in this sterile basin a liter of sterile water, and heat to 110°F. on a hot plate. If a hot plate is not available, set the flask of sterile water in a basin of hot water till it has reached a temperature of 110°F.; then pour the hot sterile water into the sterile basin.

To this liter of sterile water is added Magnesium Sulfate (Epsom Salts) crystals and the solution stirred with a sterile tongue depressor, until no more crystals will dissolve. A saturated solution of $MgSO_4$ has now been prepared. Place in the sterile solution 4 to 6 gauze compresses (4 x 4). If these are not available use a small sterile towel. Put on sterile rubber gloves, remove the compresses from the sterile solution, press out the excess solution, and apply to the inflammed area. In 2 or 3 minutes, the compress will have lost much of its heat, remove, redip into the sterile solution, and reapply to the area. Continue in this manner for one hour. Let the patient rest for two hours, and repeat the whole process, making up a fresh sterile solution each time.

The vast majority of applications of wet heat to the skin surfaces of the body are prepared with a temperature of 110°F. You should be able to determine when a solution has a temperature of 110°F. without the use of a thermometer. Water at 110°F. dropped on the back of the hand or on the anterior surface of the forearm has a comfortable, hot sensation on this skin surface. Try this three or four times so that you can tell when a solution is 110°F. Use a sterile asepto syringe to remove the sterile solution from the basin and drop a few drops on the back of your hand for the test.

b. Hot Soaks (Immersion Bath) - in this method of application of wet heat, the sterile solution ordered is placed in a sterile basin, and the inflammed area of the body placed into this solution (immersed). The medical officer will order the name and strength of the solution, how long each immersion bath will last and when the hot soak is to be repeated. You must prepare the solution in a sterile manner, and have it of the correct temperature (110°F.).

When the area to have the hot soak is covered with a dressing, the dressing will be removed, and then another sterile dressing reapplied after the immersion bath has been completed. During the hot soak, the temperature of the solution must be maintained at 110°F. This is most easily done by placing the sterile solution on a hot plate. If this is not practicable, add as needed, more sterile solution at 130°F. or 140°F. to the sterile basin to bring the original back up to 110°F.

c. Hot Massive Wet Dressing - in this method of application of wet heat to the patient's body, the inflammed area is covered with a massive sterile dressing. The dressing is soaked with the solution ordered at 110°F. and the whole wrapped in a rubber or oil silk sheet to protect the bed, and to help retain the heat in the dressing. Every hour the dressing is exposed, and more solution at 110°F. is poured over it, so as to maintain the proper temperature of the dressing. Usually one or more hot water bottles (filled half way with water at 120°F.) are placed within the rubber or oil silk sheet so that their weight is on the bed (never on the patient). These bottles help maintain the dressing's temperature at 110°F.

In those cases where there is a break in the patient's skin, absolute sterile technique must be used when applying and caring for the Massive Wet Dressing. Put on sterile gloves when applying the sterile dressing. Use sterile cotton to make the dressing massive. If a large bath towel is used as the outer layer of the dressing to add to the size of the dressing, it too must be sterile. The rubber or oil silk sheet used as the outermost layer of the dressing must also be sterile. Before using, wash well with soap, hot water and a brush. Place in 1-1000 to 1-10,000 $HgCl_2$, or a weak cresol solution for an hour or two to sterilize, or better yet, autoclave the sheet. In this manner you can be sure the rubber or oil silk sheet used is sterile. When pouring on hot solution at the one hour intervals, use sterile precautions, and do not touch the dressing with your bare hands. If you must handle the dressing, put on sterile rubber gloves. As a general rule, the massive dressing is completely changed every 24 hours. If there is much discharge or pus (etc), from the area, the medical officer may order the dressing changed more frequently.

d. Mustard Plaster - mix three parts of flour with one part mustard powder in a dry form. Add enough tepid water to make a thick paste. Spread the paste on a piece of muslin, making it large enough to cover the desired area (usually 6 inches square is large enough) and about 1/4 inch thick. Place on a hot water bottle to warm the plaster, then apply to the skin. It is usually left on about 10 minutes, and never over 20 minutes. The best rule for removing the plaster is to remove when the skin under the plaster becomes red. If left on too long a burn will result. After removing the plaster, grease the skin with mineral oil.

(Note: one teaspoonful of mustard powder in a glassful of warm water will so irritate the gastric mucosa as to cause marked emesis (vomiting).

2. Methods for Use of Dry Heat

a. Hot water bottle - is prepared by half filling with water at 120°F. Then the air is expelled by placing the bottle on its side, and the top tightly closed. The hot water bottle is always covered with a cloth cover before placing on the patient's skin. When not in use, dry and inflate so that the sides will not touch.

b. Electric Pad - especially used to apply dry heat to large surfaces for a long period of time. Do not permit the pad to get wet. If used with wet dressings, it must be rubber covered or oil silk covered.

c. Bake Oven or Lamps - these are in many sizes and shapes, adaptable for the application of heat to various parts of the body. The heat is usually generated by electric light bulbs. Usually the part to be baked is wrapped in cotton or flannel to prevent blistering. The chief hazard is the danger of burning, therefore, the technician must stay with the patient, and at the first symptoms of burning (i.e., pain and marked redness of the area), the application is discontinued.

B. Cold - is used in the very earliest stages of inflammation. It causes a constriction of the vessels in the inflammed area. It also inhibits bacterial growth, and serves to check hemorrhage from very small blood vessels. Cold relieves pain by anesthetizing the nerve endings in the skin.

1. Method for Use of Moist Cold

a. Cold Wet Compresses - the solution ordered by the medical officer (usually water), is kept cold by placing the vessel in a basin of ice, or placing pieces of ice in the solution. This type of compress is changed as soon as it loses its chill - - every 3 to 4 minutes. Do not continue longer than 10 to 15 minutes at a time. If a bluish discoloration of the skin appears, stop at once. Cold compresses are especially useful in prevention of swelling of sprains, bruises (and black eyes).

2. Method for Use of Dry Cold

a. Ice Bag - break the ice into small pieces (about 1" square). Remove air from the bag before tightly closing. Cover with a cloth cover before placing in contact with the patient's skin. The ice bag is usually used 1/2 to 1 hour on the part and then removed for a similar period so as to prevent "frost-bite", or "iceburn".

XVI. PRE-OPERATIVE CARE

Medical officers differ greatly in the detail of preparation of the surgical patient, but the general principles remain the same:

To cleanse the patient externally and internally;

To cause the least possible amount of physical and mental exhaustion in so doing.

A. Bath - the patient should have a warm tub bath the night before the operation. If impossible to give this, substitute a sponge bath in bed.

B. Mouth and Teeth - the teeth are brushed well at least twice a day and the mouth rinsed with a mild antiseptic solution (i.e., Dobell's Solution, or any other alkaline mouth wash), at least three times daily to prevent oral sepsis. Shortly before taking to the operating room, remove false teeth, bridges, gum, tobacco, etc. from the patient's mouth.

C. Diet - is usually a highly nutritious diet for several days preceding (contains such foods as meat, eggs, cooked cereals, bread, butter, vegetables, ice cream, candy, etc. The night before the operation, the evening meal is usually an ordinary soft diet. Water should be given freely up to 4 or 5 hours of the time of operation. For many patients who are dehydrated, it may be necessary to force fluids by mouth up to an hour or two before the operation.

D. Bowels - many medical officers will order a laxative (i.e., milk of magnesia 60,) or an enema (usually plain tap water or S.S. enema,) or both, the night before the operation. Probably, as many others, will desire to have the patient's intestinal tract left alone, and will order neither. The vast majority of cases will get an enema the morning of the operation (about three hours before the operation time), as ordered by the medical officer.

E. Operative Site - this site is prepared the night before the operation, after the tub bath. The region of the operative field is scrubbed well with hot water and soap. Old adhesive and grease may be removed with a sponge moistened with ether or benzine. With a new blade and a safety razor, shave the operative site carefully. The area shaven should extend one foot in all directions from the site of the incision. After shaving, wash all loose hair from the skin. This is all in the way of preparation of the operative site required by most medical officers. Some may order further care, such as the painting of the shaven area with an antiseptic and then covering the painted area with a sterile towel or dressing. If

ordered to use Tincture of Iodine, the skin must be perfectly dry before applying, and the drug removed with 70% alcohol on a sterile swab after it drys (in 3 to 4 minutes). If used on the abdomen, prevent any excess trickling down in the groin, as this may cause a burn. In summer, if the Iodine is not well removed, it may blister a "sweaty skin".

F. Sedatives - as a general rule the medical officer will order a sedative to be given orally and h.s. the night before the operation so that the patient will have a sound night's sleep. In most cases, the patient will also be given a sedative shortly before the operation, so that it will take less anesthetic agent to induce and maintain anesthesia, and also to reduce the excitement stage of the induction. There are a great many sedatives given alone or in combination in the hour or two before the operation. The medical officer will order the drug or drugs, the dose and time of administration.

Morphine + Atropine are the usual preoperative drugs given by hypodermic injection. Usual doses are Morphine Sulfate - .016 (1/4 Gr.); Atropine Sulfate - .0004 (1/150 Gr.) These are given 1 hour before operation.

G. Bladder - all patients (except urological cases) should void 1/2 hour before going to the operating room. Let him use the latrine or the urinal. When unable to void, the technician should notify the medical officer of this fact, and also the time and amount of the last voiding of urine. In some cases, the medical officer will want the patient's bladder emptied by catheterization before taking to surgery.

XVII. POST-OPERATIVE CARE

A. Post-Operative Bed (Ether Bed)

While the patient is undergoing the operation, his ward bed is prepared (as demonstrated in the classroom) as the "Post-Operative Bed". Before placing the patient in this bed, remove all hot water bottles from the bed. The patient is moved from the litter to the bed by means of the draw sheet on the litter, and covered with blankets to keep warm. If the weather is hot, it is not necessary to use blankets over the patient (unless in shock). In hot weather, blankets cause unnecessary sweating and thus the loss of fluid and body salts. The pillow is not placed under the patient's head until the patient is fully conscious and no longer nauseated or vomiting. It is best, if the patient is nauseated or vomiting, to place a large towel under the patient's head and shoulders to protect the bed, and to have an emesis basin handy.

B. The First Hour.

In the minutes that immediately follow the operation (while the patient is moved to his ward and until he recovers consciousness), the Technician should be on guard for the first serious complication - obstruction to respiration. This complication occurs only in those who have had a general anesthetic. Due to the relaxed muscles of the pharynx, when the patient lies on his back, the lower jaw and tongue fall backward, closing the passageway to the lungs. When this occurs, the breathing is dyspneic, irregular, and often very noisy. The patient chokes, and cyanosis appears. The treatment is very simple. Lift up on the lower jaw so as to close the mouth and push the lower teeth in front of the upper. Rarely is it necessary to grasp the tongue with a gauze sponge and pull it forward. Usually the lower jaw has to be held up until the patient recovers from the anesthetic enough to hold up his own jaw. Often, placing the patient on one side, and propping there with pillows, will be all that is needed to keep the respiratory tract open.

The breathing can also be obstructed by a collection of thick mucus in the throat. Turning the head (and at times the body also) to one side will help this mucus drain out of the mouth.

The breathing can be obstructed by vomitus in the pharynx and mouth, so if the patient should vomit, turn the head sharply to one side and place the emesis basin under his mouth, to assist the drainage. Often, it will be necessary to turn the vomiting patient on his side to prevent vomitus from collecting in the throat.

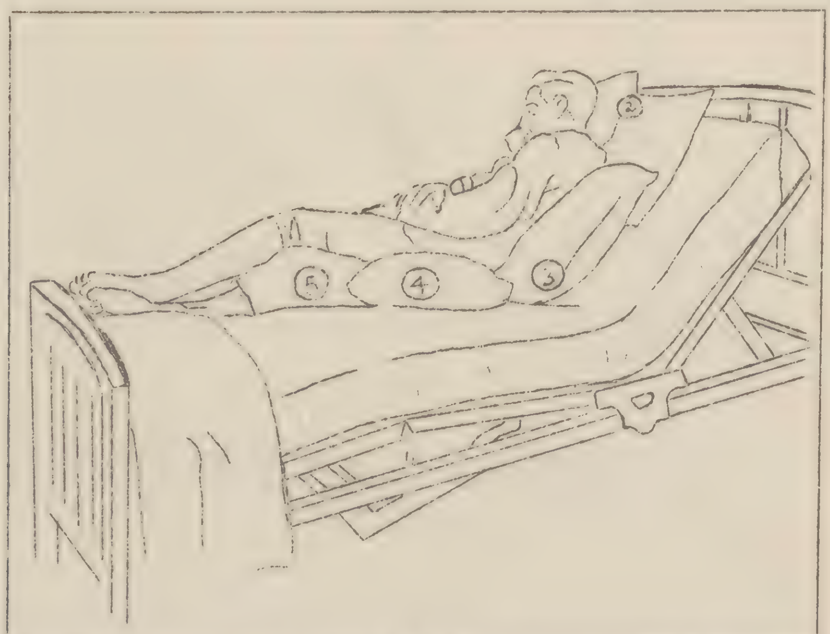
The Technician remains with the patient as he recovers from the anesthesia. The Technician must not leave the bed side until the patient is fully conscious (the patient must know who he is, where he is and what has happened to him). The bed is kept flat unless ordered otherwise. When the patient is moved into his bed, the temperature is taken and recorded. The pulse is taken and recorded every 5 minutes until he is conscious, and then every half hour for 3 more hours. If the patient is conscious on his return from surgery, take the pulse every 5 minutes for 1/2 hour and then every 1/2 hour for 3 hours. Take and record the respiration q.1/2 h. for the first 3 hours, and then q.i.d. Take the temperature q.i.h. for the first 3 hours and then q.i.d.

C. <u>After the First Hour</u>

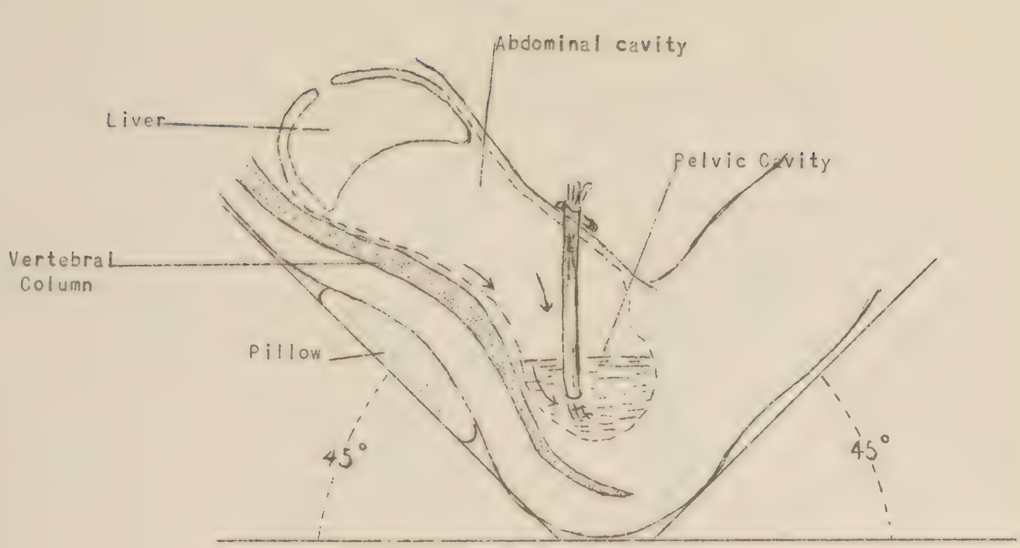
1. Take the temperature, respiration and pulse and record as directed above.
2. <u>Keep the patient quiet.</u> Use restraint sheets if necessary. Administer opiates as directed by the medical officer to induce sleep and free patient from pain. Always check for symptoms of overdosage before administering Morphine Sulfate or any other opiate. The usual dose of Morphine Sulfate is .016 (or .015). If the pain is real severe, the medical officer may order the dose of M.S. to be .03 (or .032). The .016 dose of M.S. is supposed to keep a patient free of pain for 6 to 8 hours. However, sometimes, it is necessary to repeat the dose in 2 or 3 hours or sooner, for no two patients respond exactly alike to Morphine post-operatively. Many patients develop delirium when given M.S., Hyoscine, Amytol and other sedatives pre and post-operatively. These patients have been known to tear off their dressings, walk out of the hospital in their bed clothes, fall from their bed or window and break one or more bones, etc.
3. Moisten lips to relieve thirst, and permit frequent rinsing of the mouth with mouth wash, until water can be given freely.
4. Inspect dressings for blood, abnormal drainage, etc. Reinforce dressings if necessary.
5. Carry out post-operative orders such as, set up Wangensteen Suction Apparatus, connect drainage tubes and bottles, etc.
6. Watch for and report any alarming or peculiar symptoms, i.e., marked palor or cyanosis of skin, lips, etc., skin cold and clammy, or very hot and moist, delirium, etc., severe hiccough, paralyses, marked vomiting (especially if it has a fecal odor).

7. Change the patient's position in bed every hour or two (or more often if he becomes uncomfortable), to prevent decubitus and hydrostatic pneumonia. Place small pillows or other pads under bony prominences and lower back. A large pillow placed against the patient's back makes a good support for the patient lying on his side.
8. Fowler's Position - if this position has been ordered, raise the head of the bed off of the floor 12 inches. A pillow should be placed at the foot of the bed to prevent pressure of the feet against the metal bed frame. Pillows placed under the knees to elevate them, will make the patient more comfortable and help to keep him from slipping towards the foot of the bed. If the patient is in a Gatch bed, it is easy to put him into this semi-sitting position (Fowler's position). However, the short patient is uncomfortable in this bed when in Fowler's position. To maintain Fowler's position, it is necessary to frequently lift the patient up in bed and readjust the pillows, for all will tend to slip to the foot of the bed.
9. Permit water to drink in small amounts when nausea ceases. Unless otherwise ordered, most patients are permitted water within the first 8 hours. It is best to start with small pieces of ice held in patient's mouth. If the patient does not vomit, increase the frequent teaspoon size amounts of water to larger amounts, as tolerated. In most cases, the post-operative patient will be put on a liquid diet for the first two or three days. The only items permitted on this liquid post-operative diet are: ice chips, water, broth, weak tea and black coffee. At the end of the second day (or on the third post-operative day) in most cases, the medical officer will order an enema. This sets up active peristalsis of the intestine so that the patient has a bowel movement. After the bowels have moved, the patient is permitted a soft diet. This consists of soft foods (cooked cereals, fruit juices, vegetable juices, eggs, rice, ice-cream, milk, all other liquids (no beer or alcoholic beverages) puddings, custard, junket, crackers or toast and milk, etc. Patients having dry mouths, especially those extremely ill, should have chewing gum to stimulate salivary secretion and to help prevent parotitis.

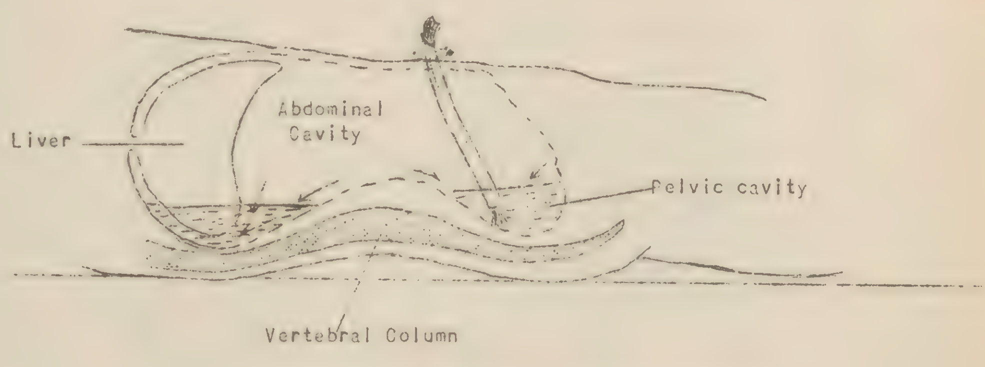
Fowler position. Note (1) pillows under arms which add to the patient's comfort. Often pillows are inserted at the patient's back and feet to give added support.



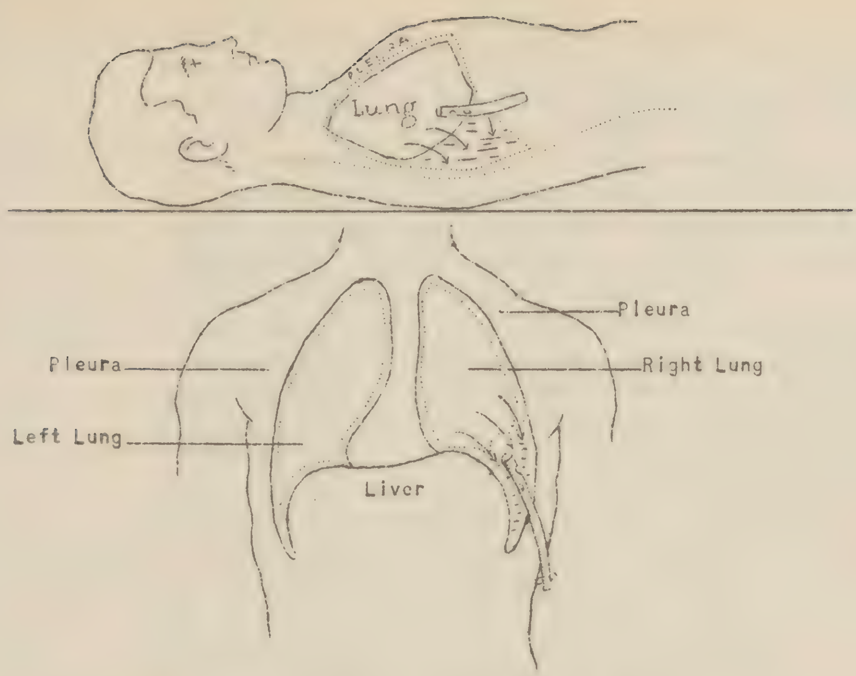
Patient turned on side in Fowler position. The break in the bed at the knee is reduced. The patient is turned on his side, his arms being supported on a pillow (1) in front of him. (2) A large pillow under the shoulders and a smaller one under the head adds to the patient's comfort. The back (3) and buttocks (4) are supported by pillows. (5) A pillow between the knees is a valuable addition.



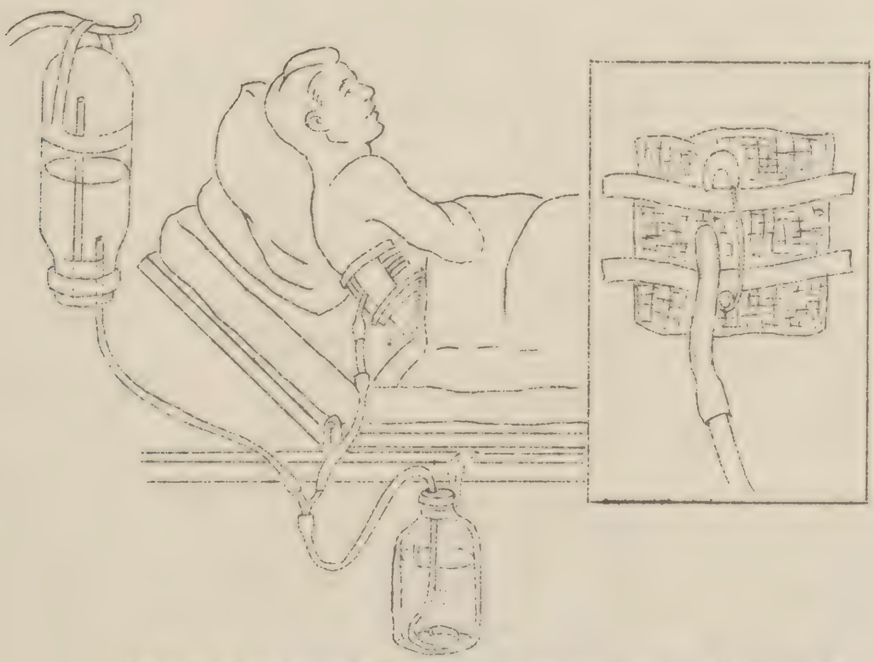
ILLUSTRATING THE EFFECT OF FOWLER POSITION IN A CASE OF PERITONITIS WITH PELVIC DRAINAGE.



ILLUSTRATING THE PUDDLING OF PUS BENEATH THE DIAPHRAGM IN A CASE OF PERITONITIS TREATED IN THE HORIZONTAL POSITION.



ILLUSTRATING EFFECT OF GRAVITY IN DRAINAGE OF CHEST WOUNDS. PATIENT IN HORIZONTAL POSITION: DRAINAGE FROM EMPYEMA CAVITY POOR. PATIENT IN FOWLER OR SITTING POSITION: DEPENDENT DRAINAGE OBTAINED.



EMPYEMA - DRAINAGE BY THE CLOSED METHOD. NOTE DRAINAGE TUBE UNDER THE FLUID IN COLLECTION BOTTLE. INSERT DRAWING SHOWS DETAILS OF SAFETY PIN ANCHORAGE OF TUBE.

10. Watch the bowels. After the bowels have moved (usually on the third day) and the soft diet begun, if the bowels do not move spontaneously every day, or every other day, a cleansing enema is usually given. If proper care is not taken of the bowels, an "impacted" rectum will result. As a rule, cathartics are not given for 1 week after most operations, and if drainage has been inserted, they are not given for a much longer time.
11. Watch the bladder. If the patient cannot void post-operatively, he must be catheterized. This is usually done 8 to 10 hours after the operation. Often the medical officer will direct a wait of 12 or even 18 hours before doing the first catheterization. Once the patient has been catheterized, if he cannot void, it must then be repeated q.8.h. (and never let the time run over 8 hours unless ordered so by the medical officer), until he is able to empty his own bladder. Exhaust all means of getting the patient to void before catheterization. Let a water faucet flow with a loud splash and have the patient concentrate his thoughts on the sound of running water, with his penis placed in a urinal. Place the patient's two hands in basins of warm water, with his penis in a urinal. Place a hot water bottle over the lower abdomen. Place warm water in the urinal, and place the penis in the urinal so that it is partially covered by the water.
12. After the first 24 hours, most patients can be put in a semi-sitting position in bed. The average case will sit out of bed on the 5th to the 7th day. However, some medical officers may order a similar case out of bed on the 2nd or 3rd day. On the first day out of bed, the patient is seated in a chair at the bed side about 15 minutes. Each succeeding day, he remains out of bed for a longer period, as his strength permits. Hernia repair cases (Herniotomy) are the one main exception to this rule. They are not usually permitted out of bed for 12 to 14 days.
13. Skin sutures are usually removed on the 5th to 7th day.
14. To relieve "gas pains" and slight distention of the abdomen, insert the lubricated rectal tube into the anus, and place the free end into a urinal between the patient's legs. Use it for twenty minutes in, then 1 to 2 hours out, and repeat till the patient is able to expel flatus (gas) freely by himself.
15. Frequent alcohol rubs and massage.

16. Watch for Post-Operative Complications
   a. Obstruction to respiration. (See The First Hour).
   b. Shock
   c. Hemorrhage
   d. Pain
   e. Restlessness and sleeplessness.
      (1) Give gentle back and neck massage.
      (2) Dim the lights and well ventilate the room.
      (3) Give warm milk, cocoa and crackers, etc., if accustomed to food at bedtime.
      (4) Sedatives as Bromides, 2. (gr. XXX)
          Luminal .1 (gr. iss)
          Codeine .06 (gr i)
          (If due to pain)
          Barbiturates (as luminal, amytal, nembutal, phenobarbital, etc.).
   f. Decubitus Ulcers
   g. Delirium

Toxic delirium is due to a general toxemia and most often occurs in general peritonitis cases and other septic conditions (severe). Usually the patient is very sick with high elevation of temperature, rapid pulse, flushed face, etc. The patient shows mental confusion, moves incessantly, disarranges the bed clothes, attempts to get out of bed, etc.

Traumatic Delirium is due to sudden trauma of any sort. There may be maniacal excitement, mental confusion with hallucinations, etc.

Delirium Tremens occurs in the habitual alcoholic who has undergone surgery or trauma. Usually after a few days of restlessness, nervousness, sleeplessness and slight mental confusion, the patient loses entire control of his mental functions and becomes maniacal. He will talk incessantly, hallucinations of fear and persecution will torment him, and often he may injure himself or others. Finally after hours of mental torture, the patient becomes stuporous. Strong sedative drugs as Morphine Sulfate, Chloral, and Paraldehyde, may be needed to keep patient quiet. It is usually best to give this type of patient whiskey.

      (1) Methods of Restraint used for all cases of Delirium:
          (a) Side boards on bed.
          (b) Cotton sheets over patient's chest, abdomen and thighs, tied or pinned to bed frame.
          (c) Ankles and wrists fastened to bed frame by straps and cuffs, or muslin roller bandage.
          (d) Sedatives by mouth, rectum or hypodermic.
          (e) Canvas restraint blanket.

h. Wound Complications

(1) Infection occurs when pathogenic bacteria have gained access to the wound. The first symptoms of inflammation usually show at the end of 36 to 48 hours post-operatively. The pulse rate increases and the temperature rises. Locally, the wound becomes tender, swollen, warm and often red. At times, if the infection is deep these local symptoms will not be evident. The treatment is usually to remove one or more skin sutures, separate the wound edges with a hemostat and insert a rubber or gauze drain. Often the wound is flushed with a mild antiseptic solution using a sterile asepto (rubber bulb) glass syringe.

(2) Hemorrhage (Hematoma)

Any undue bleeding on the dressing should be reported to the medical officer at once. At times, concealed bleeding occurs in the incision beneath the skin. This type of bleeding usually stops spontaneously and results in a clot in the wound. If the hematoma is large, it is usually drained by removing one or more skin sutures.

(3) Rupture of Wound

This is a serious complication in abdominal wounds. It results from the giving away of sutures due to infection, distention, cough, etc. The rupture may occur suddenly with the escape of coils of intestine on to the abdominal wall. Pain and vomiting are associated. The wound edges may part slowly so that the intestines escape gradually or not at all with few accompanying symptoms. The protruding coils of intestine should be covered with large sterile gauze pad or pack and compressed with adhesive bands until the medical officer can replace the intestine coils and sew up the wound.

i. Respiratory Complications; the most frequent post-operative complications to occur. Patients with some respiratory disease (i.e., nose cold, sore throat) before operation, are likely to develop these serious complications.

<u>Preventive Measures</u>:

(1) Keep patient warm after the operation, i.e., warm room, warm bed, dry bedding and garments, hot water bottles.

(2) Promote full aeration of the lungs. The patient's breathing will be very shallow because the movement of deep breathing causes pain in the operative area.
   (a) Instruct patient to take 10 or 12 deep breaths every 1/2 to 1 hour.
   (b) Mechanical apparatus such as blow-bottles may be used each hour to expand the lungs fully.
   (c) Turn the patient from side to side frequently, i.e., every 1/2 to 1 hour.
   (d) Get the patient out of bed as early as possible post-operatively, as directed by the surgeon.

<u>Complications</u> (1) <u>Bronchitis</u> (most frequent complication) characterized by cough that brings up considerable mucus, but without marked temperature and pulse elevation. Steam inhalations are of great value here.

(2) <u>Bronchopneumonia</u> (second in frequency) Symptoms for Bronchitis plus high elevation of temperature and rapid pulse.

(3) <u>Pleurisy</u> - characterized by acute, knife-like pain in the chest on the affected side, which is especially severe when the patient takes a deep breath. Therefore, the respiration is rapid and shallow, temperature and pulse elevated. A tight adhesive chest strapping with the chest in full expiration, relieves the pain.

(4) <u>Lobar Pneumonia</u> (a less frequent complication) usually ushered in by a chill and high elevation of temperature, pulse and respiratory rate. There may be little or much cough and the patient is definitely seriously sick.

(5) <u>Hydrostatic Pneumonia</u> (Hypostatic Pulmonary Congestion) - occurs in the very weak patient. Due to poor circulation of blood through the lungs, blood stagnates at the bases of both lungs. The symptoms are those of Bronchopneumonia - early slight cough, slight elevation of temperature, pulse, respiratory rate.

(6) <u>Pulmonary Embolism</u> - a blood clot forms in a blood vessel, becomes dislodged from its original site and is carried along with the blood. After passing through the heart, it is forced into and blocks a pulmonary artery.

The symptoms are among the most sudden and startling. A patient passing a normal convalescence suddenly crys out with sharp stabbing pain in the chest, becomes breathless, cyanotic and anxious.

The pulse becomes rapid, weak and irregular and cold sweat appears.

If death does not occur in 30 minutes, there is good chance of recovery.

This complication may occur at any time after the operation, but especially occurs in the second week, when the patient becomes more active. It may be that the movement dislodges the clot.

Treatment consists of administration of oxygen, Morphine Sulfate and sitting the patient up in bed.

j. Femoral Phlebitis or Thrombosis

The femoral vein in the leg becomes inflammed and the blood within its lumen clots. The cause is usually depressed circulation following the operation resulting in a slowing of blood flow. Concentration of the blood due to fluid loss also results in slowing of the blood flow. Injury to the vein by tight straps or means of restraint may play a part in the cause. The symptoms start with pain and tenderness in the calf and slight fever. A day or two later painful swelling of the entire leg develops progressively. The swelling is due to edema of the tissues.

k. Parotitis - the parotid gland may be infected by germs from the mouth that invade it through its excretory duct. It occurs up to 2 weeks post-operatively. The symptoms are those of a very acute infection. The patient becomes very sick, high elevation of temperature and a swelling in front of one or both ears. The swelling becomes rapidly larger and very tender. The pain is intense and the patient cannot chew or open his mouth. The Technician can prevent this complication by:

(1) Keeping the patient's mouth scrupulously clean with mouth washes and teeth brushing.

(2) Let the patient chew gum or hard candies post-operatively.

(3) Keep the mouth moist at all times. If the patient breathes through his mouth, several layers of gauze soaked in equal parts of water and glycerine and placed over this orifice will help.

l. Vomiting - in vomiting the stomach drains best in a sitting position or with the patient lying on his right side. Hot applications to abdomen and sips of hot tea and lemon may help.

(1) <u>During the first two or three Post-operative hours</u>: this vomiting is due to the anesthetic and usually lasts less than 2 hours. It requires no special treatment other than as given in "The First Hour", frequent use of mouth wash and withholding fluids till all nausea and vomiting has passed.

(2) <u>Continuous through the first 24 Post-operative hours</u>. This vomiting may be due to:

(a) <u>The anesthetic agent</u> (especially ether.) Give this patient a large glass of warm water with 1/2 teaspoonful of $NaHCO_3$. They will vomit this immediately, bring up much mucus. After one of two such lavages, the vomiting will usually cease.

(b) <u>Acidosis or Ketosis</u> - due to pre-operative starvation, anesthesia and diabetes, acidosis develops with vomiting. These patients have a "fruity" odor of acetone to the breath, and the urine contains acetone and diacetic acid. The treatment is intravenous glucose and fluids and often insulin.

(c) <u>Peritonitis</u> - this patient is usually very sick and toxic, abdomen usually distended, high fever and rapid pulse. The treatment is duodenal decompression by the Wangensteen Suction Apparatus.

(d) <u>Paralysis of Intestinal Activity</u> - due to injury of the abdominal organs the absence of peristalsis lasts for a period longer than usual. Hot applications to the abdomen and Wangensteen Suction is used for treatment.

(e) <u>Idiosyncracy</u> - Morphine Sulfate and other drugs often cause vomiting soon after being administered.

(3) <u>Prolonged After the First Post-operative Day</u>. Vomiting may be excessive and prolonged for 3 to 7 days, retarding recovery and threatening the patient's life. This vomiting is of a very serious type, and may be due to:

(a) Intestinal Obstruction
(b) Acute Dilatation of Stomach
(c) Uremia or Kidney Insufficiency
(d) Hemorrhage in operations on the stomach.
(e) Peritonitis.
(f) Acidosis
(g) Tetany or Alkalosis.

m. Abdominal Distention

Flatulence or distention occurs due to absence of peristalsis from handling of the intestines or trauma to the contents of the peritoneal cavity. The intestinal tract is distended with gas. It is usually relieved by use of the:

(1) Rectal Tube
(2) Small (1 pint) evacuating enemas.
(3) Heat applied to abdomen.
(4) Such drugs as follows to stimulate peristalsis.

Eserine Salicylate	.0006	(gr. 1/100)
Strychnine	.002	(gr. 1/30)
Pituitrin	1.	cc.
Pitressin	1.	cc.
Prostigmine	1.	cc.

(5) I.V. of Hypertonic Saline (5% to 30%) 100-300 cc.
(6) Spinal Anesthesia
(7) Wangensteen Suction Apparatus.

n. Peritonitis

The peritoneum is the thin, smooth, shiny covering of the walls of the abdominal cavity and the organs contained in the cavity. When this membrane is inflammed, the condition is called "Peritonitis". It results from acute appendicitis, ruptured peptic ulcer, gun shot wound of abdomen, inflammation of the gall bladder, pancreas, etc. The patient is usually very sick, with high fever, rapid pulse, and distended abdomen. This patient needs Fowler's position, Wangensteen Suction, fluids intravenously, and HMS to keep the intestines at rest. When peritonitis produces marked distention, the outcome is usually fatal.

o. Acute Dilatation of the Stomach

In this complication, on the 2nd or 3rd postoperative days, the muscle of the stomach walls relax so that the stomach cavity is greatly increased in size and filled with gas and fluid. The upper abdomen is distended and the patient vomits small amounts of foul smelling, brownish fluid frequently and without effort. The patient becomes very thirsty, and often hiccough develops. The treatment consists of Wangensteen Suction, fluids intravenously, and the patient is placed on his right side with the foot of the bed elevated. Often the condition results in death.

p. Intestinal Obstruction

This complication usually occurs after operations or injury to the lower abdomen. Usually a loop of small intestine becomes kinked due to adhesions or by being involved in the drainage tract. The symptoms

usually appear several days after the operation, 3 to 5. The patient may have had his enema on the third day and be fed a soft diet for a day or two. Then he complains of sharp, colicy pains in lower abdomen. There is usually no fever or pulse elevation. An enema, heat to abdomen, and changing patient's position from side to side with elevation of the feet may relieve the unkinked loop of gut. Usually this is unsuccessful, and the pain becomes worse, the abdomen distends and vomiting develops. If the obstruction is not relieved by surgery, death results.

q. Hiccough or Singultus

Hiccough may become a serious complication due to the nervous and physical exhaustion it can produce. It is produced by a spasm of the diaphragm. The spasm of the diaphragm results from irritation of the Phrenic Nerve. The nerve may be stimulated by a distended stomach, peritonitis, abscess under the diaphragm, distended abdomen, pleurisy, chest tumor, toxemia, uremia, intestinal obstruction, irritation from drainage tubes, etc.

(1) Treatment:
 (a) Remove the cause.
 (b) Drink 1/2 glass of water with ʒi $NaHCO_3$
 (c) Suck a lemon.
 (d) Hold the breath while taking large swallows of cold water.
 (e) Massage along course of the Phrenic Nerves in the neck.
 (f) Colon Dioxide (CO_2) inhalations by mask or by rebreathing with a paper bag held tightly over the face.
 (g) Administer H.M.S. and Atropine Sulfate.

XVIII. CATHETERIZATION

This procedure requires as careful aseptic technique as a surgical operation. Get all supplies at the bed side. The tray should include:

- Small basin to place between patient's legs to receive urine.
- Sterile cup of green soap and 3 cotton pledgets (balls).
- Sterile cup of $HgCl_2$(1-100) solution with 3 sterile cotton pledgets.
- Sterile towel wrapped in muslin.
- Sterile lubricating jelly in a tube.
- Two or more sterile rubber catheters (16 or 18 French), in sterile pan or wrapped in sterile towel.
- One or two sterile forceps or hemostats.
- One sterile rubber glove in sterile glove holder.

Method: Place the small basin between the patient's thighs to receive the urine. Scrub your hands well with soap, hot water and brushes for at least 3 minutes. Tell the patient to place his hands behind his head and to keep them there until you have finished. Tell him what you are going to do. Place the sterile towel over his lower limbs well away from the pubic region. Hold the shaft of the penis with one hand, well away from the head. Scrub the head of the penis well with the three cotton balls in the sterile cup of green soap. These can be handled with your fingers. Then, wipe off the head of the penis well with the three sterile cotton pledgets from the sterile cup of $HgCl_2$. These pledgets are handled with a forceps or hemostat, and never your fingers.

Handling the sterile towel by its edges, pull it up close to the pubic region, taking care not to contaminate the upper surface. Place the sterilized head of the penis on the top of the sterile towel. Squeeze a 1 or 2 inch ribbon of lubricating jelly from the sterile tube on to the top of the sterile towel, using sterile precautions so as not to contaminate the tube. Put on one sterile glove.

Pick up a catheter with the gloved hand, dip the blunt end into the sterile, lubricating jelly, and insert into the penis. The penis is held by the shaft with the bare hand, keeping well away from the head of the penis. When the catheter has been inserted some 5 to 6 inches (depending on the length of the penis), it will usually meet an obstruction. This obstruction is caused by the tightly closed sphincter muscle at the base of the bladder. A little steady, gentle pressure on the catheter will cause it to relax in a few seconds, and the catheter will slip into the bladder. The urine will flow freely when the catheter enters the bladder.

If a sterile urine specimen is desired, the sterile end of the catheter is held over a sterile urine specimen bottle, and the urine permitted to flow from the catheter directly into the sterile bottle. When 100 to 150 cc. of sterile urine has been collected, the bottle is closed with a sterile cork, or covered with a sterile gauze sponge (4" x 4") and a rubber band.

If a rubber glove is not available, the sterile catheter can be picked up and held with a sterile hemostat or thumb forceps for insertion. Many medical officers will permit the technician to pick up the sterile catheter, separated from his fingers by 2 or 3 sterile gauze sponges (4" x 4"), when rubber gloves are not available.

1. <u>The Bladder Instillation</u>:

   To instill fluid into the bladder (Bladder Instillation) means fluid is injected into the bladder through a catheter, and then the catheter removed so as to leave the fluid behind in the bladder.

   Often when a patient has to be catheterized more than once, the medical officer will order some mild antiseptic solution to be instilled into the bladder, as an added caution against possible infection. He will always write the name of the medicine, the strength of the solution and the amount to be instilled. Get the correct medication in a sterile medicine glass, and before inserting the catheter, transfer the solution into a sterile rubber bulb syringe (asepto syringe). When the bladder has been drained, place the syringe on the end of the catheter, and holding the syringe so as not to inject any air into the bladder, transfer the antiseptic into the bladder. Stop the injection before all of the solution enters the bladder so as to avoid the injection of air into the bladder; pinch off the catheter and pull out of the urethra.
2. <u>The Retention Catheter</u> (Indwelling Catheter)

   Often the catheter is inserted into the bladder and fastened there with string or tape and adhesive tape, so that the bladder is kept dry. This type of catheter may be left in position for days or weeks. The technique of fastening the retention catheter in place will be demonstrated on the practice ward.
3. <u>The Bladder Irrigation</u>.

   Often when the patient has a retention or indwelling catheter, the medical officer will write an order for bladder irrigations, to keep the bladder and catheter clean. He will always write the name of the medicine, and strength of solution to use. He will not state the amount or the temperature to use. When preparing the solution, it is customary to prepare about 500 cc. for the bladder irrigation, although in most cases, you will need but half this amount (about 1 cup). The temperature of the solution is about body temperature (100°F. to 105°F.).

Prepare the 500 cc. of ordered solution of the correct strength, using the stock solution found in the medicine cupboard, sterile water and a sterile basin, so that the resulting solution is sterile. Use a small rubber bulb syringe (1 to 2 ounce syringe is suitable). Inject the syringeful of irrigating fluid into the catheter, and permit it to return at once into a basin between the patient's thighs. Continue the irrigation until the irrigating fluid returns clear.

If the end of the catheter to which the syringe is attached is grossly contaminated, wrap it for 10 minutes in a sterile sponge wet with 70% alcohol before starting the irrigation.

XIX. THE DRESSING OF WOUNDS

Rigid aseptis is the most important requisite for the successful care of wounds. Clean wounds (those made aseptically) are usually closed by sutures, after careful ligation of all bleeding points. All other wounds are potentially infected, and cannot be closed until every effort has been made to remove all devitalized tissue and infection. A formal operation is therefore performed for the purpose of cutting out the infected and devitalized tissue. This operation is called "debridement". Often a small drain is inserted before suturing such a wound, to prevent the collection of blood and lymph, which would retard healing if allowed to remain in the wound.

Wounds are usually dressed with several layers of sterile gauze held in place by bandages or adhesive tape. Clean wounds without drainage seal within 24 hours by the coagulation of lymph between their edges. Such wounds need no dressing until the time for removal of sutures, unless some wound complication develops. Clean wounds are often drained when absolute hemostasis is difficult to obtain. Such wounds are dressed in 24 to 48 hours, and the drain removed, for hemostasis will be complete by that time. Infected wounds are dressed at least once each day. Infected wounds may have to be dressed two or three, or more, times daily if the dressing is grossly soiled.

The Clean Wound (Aseptic or Sterile Wound).

When changing the dressing, moisten the adhesive with benzine to loosen it, so that it is easily removed by pulling on it horizontal to the skin surface. The old dressing is removed and placed in a paper bag so that it can be easily disposed of by burning. If this dressing is soiled with discharge, handle it with a forceps or hemostat and not your hands. Everything that goes near the wound must be sterile. If a drain is to be removed, grasp it with a sterile forceps or hemostat. If skin sutures are to be removed, grasp them, and cut with sterile instruments (forceps and scissors). If the wound is to be swabbed with alcohol or other antiseptic, use sterile cotton pledgets or sterile 2" x 2"'s held in sterile forceps or hemostat.

Sterile gauze compresses to form the new dressing are placed on the wound handled with sterile instruments. If a large dressing is desired, after first applying 3 or 4 gauze compresses, a sterile "ABD" pad is applied. This pad is also called the "Abdominal" pad or "combine". They are made of cotton folded in a layer of gauze.

The adhesive tape is usually used in wide (3") strips for chest and abdominal dressings. The top strip is usually placed half on the skin and half on the dressing, so that the patient cannot lift up the upper edge of the dressing. The other strips are placed to expose gauze between them to allow inspection of the top surface of the dressing. If frequent dressings are to be needed, use the Montgomery tape dressing. With this dressing, the adhesive tapes are tied over the top of the dressing with gauze or string ties, thus making it unnecessary to remove the adhesive from the skin each time the dressing is changed.

The Draining Wound (Dirty, Septic, Infected Wound)

The dressing of the wound provided with drainage is carried out as described for the sterile wound, taking every precaution to prevent the spread of the patient's germs elsewhere on the patient, to yourself or to others. The vast majority of wounds with drainage, have that drainage because they are infected with germs. If the dressing is stuck to the edges of the wound, loosen it by moistening with H_2O_2. To do this, you must use a sterile asepto syringe and a small sterile basin to hold the H_2O_2. Hold an emesis or kidney basin to prevent the solution from soiling the bed. Often such wounds are irrigated with H_2O_2 or other antiseptic solutions, using the same sterile materials, and placing the tip of the syringe into the wound to well wash out the pus.

The drainage from infected wounds is often irritating to the surrounding skin. Vaseline gauze or other ointments (i.e., Zinc Oxide Ointment) are used to protect this skin. Wounds infected with virulent pathogenic bacteria (i.e., gas bacillus in gas gangrene cases), call for absolute sterile technique, for if the Technician permits a break in his dressing technique, he is endangering himself and others with a death producing germ.

1. Wear gloves when doing the dressings in such cases.
2. Do not touch the dressing or any object that goes near the wound with your gloved hands. Handle all objects used in the dressing with forceps or hemostats.
3. As soon as the old dressing is removed, place it at once in a paper bag or wrap in newspaper so that it can be burned as soon as the dressing is finished.
4. All instruments used to do the dressing are placed in a pan or basin as they are discarded, and at the end of the dressing, washed with gloves on, and placed at once in boiling water for 30 minutes or autoclaved at once.
5. If possible, isolate such patients, and have a separate dressing tray or cart used only for these cases. Where possible, the best technique is to have one technician care for these seriously infected cases, and this Technician should not be permitted to care for the clean cases.
6. Bed clothing, pajamas, etc., from such cases, should be sterilized by placing in 1-50 Lysol or Cresol Solutions for 1 hour before being placed in boiling, soapy water for washing.
7. Scrub your hands well with soap, hot water and brushes when finished with the dressing.

In the case of the gas bacillus, since it is an inhabitant of the human intestinal tract, it is liable to be an infecting organism in wounds of the lower limbs and pelvic region of the body, especially if the patient is incontinent. In such cases, special care must be taken to keep the bed clean and dry, and a close watch kept of the patient to clean the bed and the patient as soon as there has been a fecal discharge from the bowel. Wounds and dressings must be protected in such cases by means of sheets of oil silk applied over the dressing, and wide strips of adhesive to seal the edges of the oil silk sheet to the skin.

DRESSING CART

Group I - Dressings

(1) 1 can 2" x 2" (sterile) gauze sponges.
(2) 1 can of 4" x 4" (sterile) gauze sponges.
(3) 1 can of 4" x 9" (sterile) gauze sponges.
(4) 1 can Abdominal Pads (sterile) (Combines or A.B.D.'s)
(5) Iodoform Gauze (1 inch) in bottle.
(6) Vaseline gauze in various sizes (sterile).
(7) Large rubber drains in sterile bottle.
(8) Small rubber drains in sterile bottle.
(9) Roller Bandage (2" and 3").
(10) Absorbent Cotton (sterile) in covered can or muslin.

Group II - Antiseptics

(1) Alcohol 70% (500 cc.)
(2) Iodine, 3 1/2% or 7% (℥ IV).
(3) Tincture of Merthiolate (℥ IV).
(4) Gentian Violet, 1% (℥ IV).
(5) Balsam of Peru (2 to 4 ounces).
(6) Hydrogen Peroxide (H_2O_2) (500 cc.).
(7) Dakin's Solution (500 cc. in dark bottle).
(8) Boric Acid, 5% (500 cc. in sterile bottle).
(9) Powdered Sulfanilamide (usually put up in sterile test tubes)
(10) Silver Nitrate ($AgNO_3$) (Lunar Caustic) in stick form.
(11) Sulfanilamide Ointment, 10%.
(12) Scarlet Red Ointment, 5%.
(13) Boric Acid Ointment, 5%.

Group III - Instruments

(1) Sterile pan and cover containing: (one or more)
- (a) Tissue forceps
- (b) Suture scissors
- (c) Hemostats
- (d) Probes

GROUP IV - Miscellaneous

(1) 1 sterile pan and cover containing:
- (a) Tongue depressors
- (b) Eye droppers
- (c) Medicine glasses
- (d) 1 ounce rubber bulb glass syringe(asepto)

(2) Bandage scissors
(3) Can containing sterile:
- (a) Cotton swabs
- (b) Cotton pledgets
- (c) Tongue depressors

(4) Adhesive tape, 3"

(5) Emesis basin (kidney or pus basin).
(6) Safety razor and extra blades.
(7) Sterile towels (wrapped in muslin).
(8) Ether (1/4 lb. cans).
(9) Compound Tincture of Benzoin. (4 ounce bottle).
(10) Large paper bags to receive soiled dressings, etc.
(11) Small sterile basin for irrigating solutions (wrapped in muslin)

XX. COMMUNICABLE DISEASES

A. Definition - an infectious or communicable disease is one which can be transmitted from one person to another and one caused by living organisms.

B. Methods of Transmission
   1. Direct contact. Touching some person who has the disease.
   2. Indirect contact - personal belongings, clothing, papers, books, etc.
   3. Droplet infection - breathing, coughing, sneezing, etc. This is the way in which the respiratory diseases and most of the so-called "diseases of childhood" are transmitted: measles, mumps, diphtheria, etc.
   4. Excreta - intestinal diseases and diarrheal diseases.
   5. Insects - malaria - spotted fever and many tropical diseases, etc.
   6. Food and water - Typhoid, etc.

C. Clinical Aspects.
   1. Each disease has a definite clinical picture, is caused by a definite organism, is transmitted in a rather definite manner, and a large number of them produce immunity.
   2. These diseases are all communicable, usually produce fever and various degrees of toxemia.
   3. They are frequently accompanied by, or they may leave complications.
   4. Some of them run a definite course, and the duration is not greatly affected by medicine. However, the degree of severity and complications are affected by medication.
   5. Many of these diseases can be prevented.

D. Methods of Prevention.
   1. Isolation - separation of one patient from another except where both have the same disease. No visitors; furniture, books and other articles not removed from the room, unless sterilized. Nurses and technicians should not go to other parts of hospital while working in isolation - some exceptions.
   2. Vaccination - Small Pox - Typhoid - Diphtheria, etc.
   3. Immunes - those people who have either had the disease, or by repeated small doses of the causitive organism, or by vaccination, are not capable of having the disease. Immunity may be either active or passive. Active immunity is built up by a reaction in the body to the disease, usually by having the disease or by vaccination. It is produced by reaction to a toxin. Passive immunity is quick and usually lasts a short time. It is brought about by giving the patient some sort of antitoxin.

E. Technique of Isolation
   1. The patient, or patients having the same disease are isolated in a ward or room.
   2. The technician usually wears a cap, a mask and a gown. These are for his own protection, and to prevent him from becoming contaminated so that he may transmit the infecting organism to others from clothing, etc.
   3. Only immunes should be assigned to work on a contagious ward, except in an emergency.
   4. Before leaving a ward for work in another part of the hospital, the technician should be tested for being a carrier. A carrier is a person who harbors the disease and may transmit it to others without becoming ill himself.

F. Unit of Isolation
   1. The disease is the unit of isolation. Where there are many cases of the same disease, all cases of the same disease are put together. For example, measles cases are not mixed with mumps cases.
   2. The same surgical gown may be worn to administer to all patients with same disease, as there is no danger of "cross infection".
   3. All utensils, i.e., dishes, trays, cutlery, bathtubs, thermometers, bedpans, urinals, rectal tubes, etc., are carefully marked and isolated and disinfected after use and are kept in that ward - not permitted to leave the ward.
   4. All bed linen and gowns are disinfected. Technician must "scrub-up" before entering and after leaving the ward.
   5. Nothing is removed from the unit before being sterilized.
   6. A cap, gown and mask are worn with all diseases, as: meningitis, diphtheria, measles, influenze, pneumonia, scarlet fever and plague.

G. Procedure for Putting on a Surgical Gown to Treat Patient.
   1. The gown with long sleeves should be hanging up at a convenient place near a sink with running water, if possible, or a wash basin and water with disinfectants and soap within reach. The gown is hung with the right side outward. Two brushes are kept constantly in a disinfecting solution (Lysol) for washing before putting on a gown.
   2. As the technician enters the isolated unit he first puts on his surgery cap and over it ties on his face mask.
   3. The hands are then scrubbed for three (3) minutes each hand, first one and then the other. A clean brush is used for each hand. Soap and warm water are the agents used. In some cases it is permissible to just dip the hands in a Lysol solution before and after caring for the patient, such as in mild cases of infection, i.e., mumps or measles.

4. The hands are than dried one at a time with paper towels. The towels are discarded in the waste basket or similar container, to be burned.
5. The technician then takes the gown from the hanger by grasping it by the inside (uncontaminated), slips first one arm in and then the other. The ties are then tied from top to bottom in back and the belt is also tied bringing the ends to the front, if possible. This lessens the chance of contamination of the belt. The technician proceeds with his duties.

H. Removing the Gown
1. Scrub hands as before.
2. Loosen all ties.
3. Remove gown by drawing out one hand, then the other, allowing clean hands only to come in contact with inner part of gown.
4. When gown is off, hang on usual hanger, nail or clothes tree as before, with outer surface to outside.
5. Remove cap and mask.
6. Wash hands well, again with soap and water or dip in disinfecting solution and dry.

I. Sterilizing or Disinfecting of Utensils.
1. Composition of the article must be considered. Anything that can be steam sterilized or boiled in hot water should be done so, i.e., dishes, bedpans, urinals, rectal tubes, etc. Dishes are boiled 10 minutes; other items 20 minutes.
2. Thermometers are placed in alcohol for at least 30 minutes.
3. Combs can be steam sterilized 20 minutes, or placed in a bichloride solution, 1-5000 for 30 minutes.
4. Stethoscopes, etc., are wiped off with alcohol and a clean cloth; allowed to dry or placed in the sun.
5. If any article cannot be steam sterilized, boiled, or placed in a disinfection solution, it may be aired 12 hours in the sunshine and considered clean.
6. In dusting a room, utensils may be dusted off with a damp cloth, which has been moistened with carbolic acid, 1-40 or bichloride of mercury, 1-1000.

J. Disinfecting Linen.

All linen from isolated patients is kept in a separate laundry bag and sent to the laundry marked "contaminated". There it is placed at once in boiling soapy water.

K. Excreta Disposal.

All urine and feces are emptied immediately and the bedpan sterilized in a steam sterilizer or placed in a 1-40 solution of carbolic acid. Any specimens sent to the laboratory are marked "contaminated" and a clean wrapper of some kind, i.e., a paper bag or paper towel, is wrapped around the outside of the container. Chlorinated lime, 3-5% is used to disinfect body discharges. Feces is broken up, covered with lime, and allowed to stand at least one hour before flushing into the sewage system.

L. Precautions for Technicians

1. Each must consider his own health, as well as the patient's. It is necessary to be very cautious of one's individual technique in regard to bodily contamination.
2. Factors to remember.
    a. Try not to get close to the patient who sneezes. Scrub with soapy water should a patient sneeze in your face.
    b. Build up your own bodily resistance by the right kind of food, exercise, fresh air, rest and sleep.
    c. Avoid worry, fatigue, exposure to cold, constipation, cuts, abrasions, scratches, common colds or anything which may have a tendency to lower your resistance.
    d. In nursing pneumonia, patients avoid infections of the mouth, nose or throat, enlarged diseased tonsils. If you have a cold or respiratory infection, keep away from pneumonia cases.
    e. Cultivate the habit of not putting your hands to your face or putting such articles as pens, pencils or pins into your mouth.
    f. Gargle or nose spray may be used very effectively in preventing diseases from spreading.
    g. Wash hands with soap and water often.
    h. Keep fingernails trimmed and clean.
    i. Masks are worn for all respiratory cases and all highly contagious cases.
    j. When contaminated, if it is necessary to turn a faucet or open a drawer, the hand should be covered with a clean paper towel.

XXI. EYE, EAR, NOSE AND THROAT

A. Nursing of the Eye

1. Eye Drops

Tilt patient's head backward, and incline slightly to the side so that the solution will run away from the tear duct. In most cases it is well to press the inner angle of the eye after instilling the drops to prevent the excess of the solution from entering the nose. Depress the lower lid with the fingers of one hand and a bit of cotton. Tell the patient to look upward, and drop the solution on the everted lid. After placing one or two drops in the eye, release the lid, and catch any excess of the fluid that runs on the cheek with the cotton. Take care that the dropper does not touch any part of the eye or lids.

2. Eye Irrigations

These are usually used on cases of inflammation to remove the discharges from the eye. The medical officer will always order the name of the solution to be used and its strength. He will not state how much or what temperature to use. Usually 150 to 250 cc. of solution will suffice (about 1/2 to 1 cupful). The temperature is always close to body temperature, about 100°F. The apparatus used may be a medicine dropper, a small rubber bulb, glass syringe (asepto) or the glass tip of the medicine dropper attached to an irrigation can with a rubber tube. The apparatus and solution must be sterile.

Sit the patient up with the head tilted backward, and inclined to the side to be treated. The patient holds a kidney or emesis basin against the side of his face to catch the fluid as it drains from the eye. Stand in front of the patient, and with a sterile pledget (cotton) wipe the discharge from the eyelids and lashes, with a movement away from the nose. After cleaning the outside of the lids in this manner, hold them open with one hand, and flush the eye with a gentle stream of fluid, directing the stream away from the nose. If the stream is directed toward the nose there is every danger of infecting the other (good) eye. Continue to irrigate until the eye is free of secretion. Use little or no force. Touch no part of the eye ball, lids or lashes with the tip of the dropper or syringe used. For your own protection, wear rubber gloves to protect your hands from the discharges.

3. <u>Hot Compresses</u>

Cover the patient's chest with a towel. Anoint the skin of the cheek, lower forehead and eye lids with mineral oil, vaseline, or other bland ointment. Prepare in a sterile basin, the sterile solution of the correct strength as ordered by the medical officer. Usually 500 cc. to 1 liter is more than enough. Heat the sterile solution to 110°F. and use a hot plate at the bedside to keep it at the correct temperature. The most frequently used solution is Boric Acid (2% to 5%).

Place in the basin 3 or 4 sterile gauze compresses (4" x 4"). Squeeze the excess solution from 2 or 3 of the compresses, apply to the eye, and leave in place till it cools. In the vast majority of cases it is best to remove the compress and redip in the hot solution after one minute. The process is continued in most cases for 15 minutes every 2 to 3 hours. The medical officer will always order how long to continue the treatment and how often to repeat the treatment.

After the treatment, dry the eyelids and skin of the cheek with cotton pledgets. If infection and discharge is present, wear rubber gloves for your own protection when carrying out this type of treatment.

4. <u>Removal of Foreign Bodies</u>

Locate the body, first by looking behind the lower lid. Evert the lower lid by pulling down on the skin of the upper cheek, and having the patient look upward. If the body is not located behind this lid, examine the upper eye, by turning the upper eyelid inside out. To do this, stand in front of the patient, and instruct him to look at his feet. Grasp the lash of the upper eyelid with one hand. Place a matchstick, swabstick, etc., across the upper part of the lid. Pull out and up on the eyelash and push down with the small stick. This will evert (turn inside out) the upper eyelid.

The foreign body may be removed by touching it with a dry sterile cotton swab, or better yet, have it moistened with boric acid solution or normal saline. If the foreign body consists of many tiny pieces, it is best to remove by irrigating the eye. If the body does not come away easily, it is probably embedded in the outer layer of the eye ball or the eyelid, and must be removed by the medical officer. Embedded, foreign bodies are usually hot when they strike the eye, and thus burn into the eye or lid surface.

5. <u>Eye Ointments</u>

Eye ointments are applied to the eye much like eye drops. Evert the lower eyelid and squeeze a ribbon of eye ointment about 1/2 inch long on to the inner surface of the lower eyelid. Do not touch the eyelid with the tube.

B. <u>Nursing of the Ear</u>

1. <u>Ear Irrigations</u>

The ear canal is about 1 to 1 1/2 inches long. It is a blind passageway for the inner end of the canal is completely closed by the ear drum. To straighten this canal, pull up and back. This is done for all irrigations.

a. <u>Irrigations for the Removal of Discharge</u>

The medical officer will always order the name and strength of the solution to be used. He will not state how much solution or what temperature to use. This the Technician should know. The solutions are prepared so that they feel warm to the ear, a temperature close to body temperature (100°F. to 105°F.). The usual amount prepared is 240 cc. (1 cupful). The apparatus used may be the small red, rubber ear syringe, or a small rubber bulb glass syringe (asepto) or a medicine glass tip attached to an irrigating can by means of a rubber tube. The solution and the apparatus must be sterile. Seat the patient in a chair with his head inclined slightly to the affected side, cover the shoulder with a towel to protect the clothing and have him hold an emesis or kidney basin tight to his body just under the ear, to catch the irrigating fluid as it runs out of the ear. Place the tip of the irrigating apparatus in the opening of the ear canal, so as not to block the return flow. The flow should be very gentle. If the irrigating can is used, hang it about 1 foot above the level of the ear. Continue the irrigation until the irrigating fluid returns clear. The medical officer will always order the number of such irrigations he wishes the patient to receive each day.

Following the irrigation, dry the external ear with a cotton pledget. If the discharge is profuse, keep the patient lying with the infected ear downward, so as to get good drainage between irrigations. <u>Never plug with cotton the ear canal of an infected (draining) ear.</u> This serves as a plug to dam back the pus, and will result in destruction of the ear drum, the ear bones and deafness. If the ear must be dressed, because the discharge is profuse, place 2 or 3 sterile gauze compresses (4" x 4") on the outside of the ear, and fasten in place by roller bandage about the head.

b. Irrigation for the Removal of Cerumen

Cerumen (ear wax) is removed by washing out with a forceful stream of plain water. First soften the mass of cerumen by using warm oil, H_2O_2 or warm glycerine as ear drops. After instilling the drops, wait 15 minutes or a half hour and then irrigate with tap water. Use tap water at body temperature (about 100°F.). Use the large ([illegible]) metal ear syringe (Kramer syringe). Protect the patient's clothing with a towel over his shoulder and a basin under the ear to catch the returning fluid. Pull the ear lobe up and back to straighten out the ear canal. Place the long tip of the syringe into the opening of the ear canal, but do not block the canal. Aim the syringe so that the fluid hits the posterior wall of the ear canal first. Never inject the fluid straight into the canal, for it may strike the drum and rupture it. If the fluid first hits the posterior wall of the canal, its force is reduced before it reaches the drum. Continue irrigating until the mass returns with the irrigating fluid. It may require a liter or two of fluid to dislodge the cerumen mass.

C. Throat Irrigation

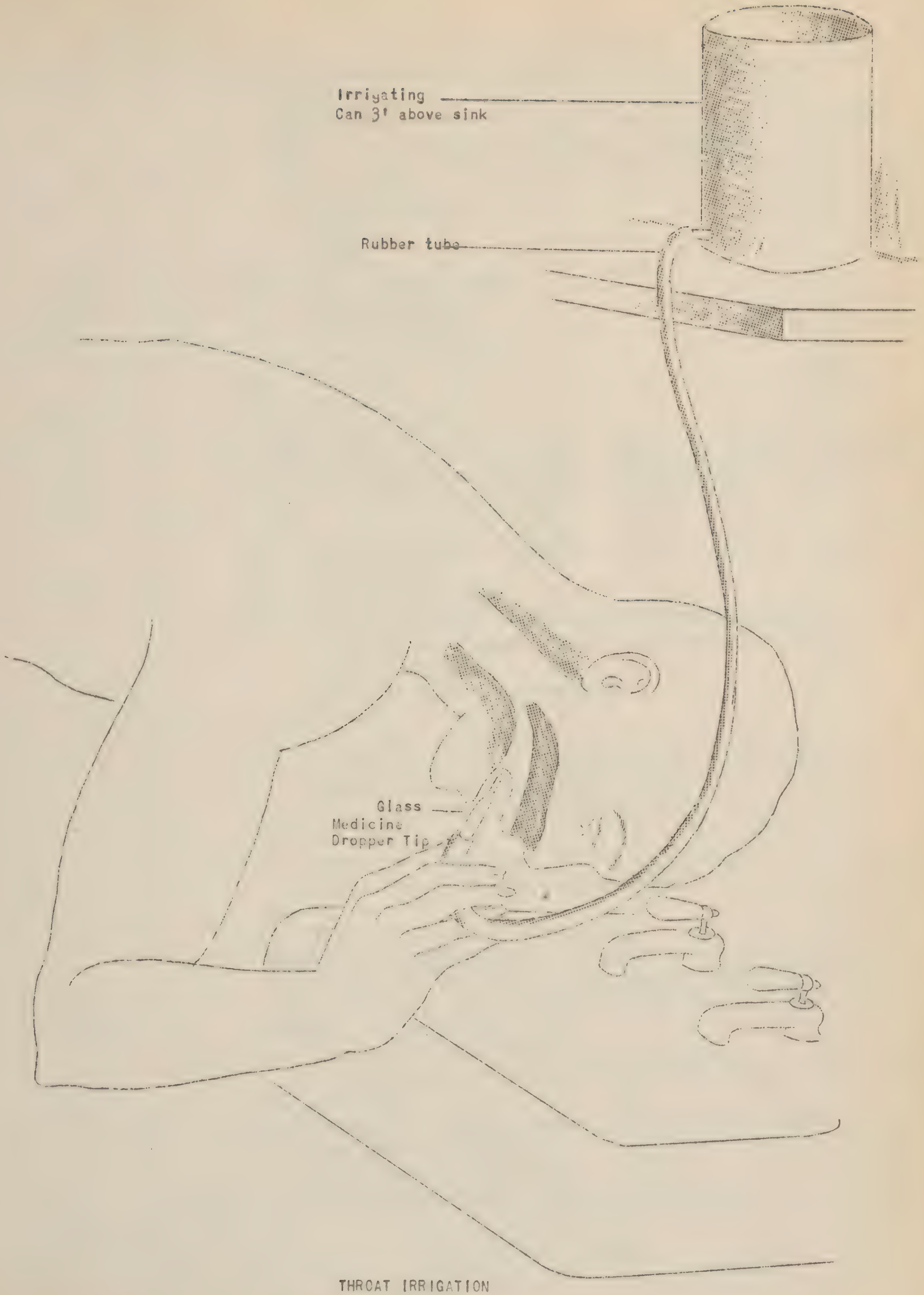
The medical officer will always write the name and the strength of the solution to be used. The Technician should know the temperature and amount to prepare. In most cases 2 to 4 liters of solution at 120°F. is prepared.

The apparatus used consists of a glass medicine dropper tip attached to the irrigating can by means of a rubber tube. The apparatus and solution are sterile. The patient is seated in front of a sink, and the irrigating can set on a shelf 2 feet above the level of his throat. If the patient is confined to bed, have him hang his head over the edge of the bed, place a slop jar on the floor to receive the return flow of the irrigating fluid, and hang the irrigating can on a standard two feet above the level of the patient's head.

Direct the patient to bend his head over the sink or slop jar, and to place the medicine dropper glass tip well into his mouth, aimed at the back of his throat. The fluid flows from the tip, hits the back of the patient's throat and then falls downward out of the patient's mouth into the sink or slop jar. While the solution flows over the throat tissues, the patient must hold his breath. Direct him to pinch the rubber tube with his holding

fingers to shut off the flow of irrigating fluid when he has to breathe. Then direct him to let the irrigating fluid flow while he holds his breath. This process is continued until the throat has been irrigated for 15 to 20 minutes. Often the patient will tire in 8 or 10 minutes time, and then the treatment will have to be discontinued. The treatment is used in cases of inflammation of the throat tissues, and its main function is to apply heat to the area. The longer it can be continued at one time, without exhausting the patient, the better the treatment will be. The medical officer will always direct the number of times each day the treatment is to be carried out.

Often the patient may complain that the temperature of the solution feels hot or cold to his throat. The patient's own feeling of heat and cold is a good guide to determine the temperature of the throat irrigation, for often the irrigation may be given at 130°F. or 140°F. "<u>Give as hot as the patient can comfortably stand</u>".



THROAT IRRIGATION

XXII. DIETS

A. Medical Diets - Medical Diets are classified as to consistency.

1. Liquid Diet - A liquid diet is fluid, bland, easily digested and has low residue. The patient is fed about every 2 hours from 8:00 A.M. to 8:00 P.M. Included are:
    a. Cereal gruels
    b. Milk
    c. Broths
    d. Tea, coffee, cocoa
    e. Fruit juices
    f. Strained soups
    g. Ice cream (plain)
    h. Egg nog
    i. Ginger ale, etc.
    j. Tomato juice.
2. Soft Diet - A soft diet is a liquid diet plus a few easily digested solids. The patient is fed every 3 to 4 hours, from 8:00 A.M. to 8:00 P.M. Included are:
    a. Cooked cereals (oatmeal, Farina, Cream of Wheat)
    b. Milk toast
    c. Crackers in milk
    d. Eggs - poached, soft-boiled, soft-scrambled
    e. Puddings - tapioca, gelatin desserts, Jello, cream puddings
    f. Custards - baked or boiled
    g. Junket
    h. All items in liquid diet
    i. Fruits - oranges, stewed fruits, baked apples, canned peaches and pears, etc.
    j. Vegetable purees - beets, carrots, beans, peas, spinach, squash
    k. Potatoes - baked or boiled or mashed
    l. Macaroni and spaghetti, noodles
    m. Rice
    n. Cheese - cream and cottage.
3. Regular or Solid Diet - A regular diet is a normal diet with all fried, highly seasoned and indigestible foods omitted. The patient is fed three times daily. Included are:
    a. Fruits - raw or cooked (no melons)
    b. Vegetables - raw or cooked (no turnips, etc.)
    c. Cereals
    d. Bacon, beef, lamb chops, liver, fowl, fish (no pork or veal)
    e. Cake, cookies, breads
    f. All items of soft, and liquid diets.

B. Post-Operative Diet

1. Abdominal Cases (except stomach and bowel cases)
    a. First day - after 8 hours, if no nausea, allow tea, tap water and warm broth, NO MILK, no fruit juice.
    b. Second day - same as first day.
    c. Third day - after enema has been effective, give soft diet.
    d. Fourth day - same as third day.
    e. Fifth to seventh day - solid or regular diet.
2. Stomach and Bowel Cases - operations on stomach, intestine, gunshot wounds of the abdomen, etc.
    a. First, second and third days - give the patient nothing by mouth. Use the Murphy Drip (except in colon and rectal cases) and venoclysis to administer food and fluid.
    b. Fourth day - allow 1 ounce quantities of tea, tap water, strained orange juice every half hour, or other fluids as ordered by medical officer.
    c. Fifth day - increase the same liquids as above to 4 ounces every 2 hours.
    d. Sixth day - add fruit juices and clear, non-irritating broths.
    e. Seventh day - add cereal gruels to the diet, milk, ice cream, custard, etc.

XXIII. ABBREVIATIONS

1.	ac	- 20 minutes before meals.
2.	pc	- immediately after meals (1 to 5 minutes)
3.	hs	- bed time
4.	b.i.d.	- twice daily (10:00 A.M. and 4:00 P.M.)
5.	t.i.d.	- 3 times daily (10:00 A.M.;2:00 P.M. and 6:00 P.M.)
6.	q.i.d.	- 4 times daily (8:00 A.M.;12:00 noon; 4:00 P.M. and 8:00 P.M.)
7.	q.2.h.	- every two hours, i.e., 6:00 A.M.;8:00 A.M.; 10:00 A.M.
8.	q.6.h.	- every six hours, i.e., 6:00 A.M.;12:00 noon; 6:00 P.M.
9.	prn	- as required (as necessary)
10.	S.c.s.	- if necessary
11.	stat	- immediately (at once)
12.	ad lib	- freely
13.	ung.	- ointment
14.	tinct.	- tincture
15.	Sat.Sol. or S.S.	- saturated solution (also means soap-suds when refering to an enema).
16.	gtt	- drop
17.	m.	- drop (minum)
18.	aa	- of each
19.	et	- and
20.	$\overline{\overline{ss}}$	- half
21.	$\bar{c}$	- with

22. qsad - add sufficient quantity to make.

23. div. - divide

24. Sig. - give the following directions

25. R_x - take

26. ʒ - dram (4 cc.) (teaspoonful)

27. ℥ - ounce (30 cc.)

28. H.M.S. - hypodermic injection of Morphine Sulfate

29. qs - sufficient quantity

30. H_2O - water

31. H_2O_2 - Hydrogen Peroxide

32. $AgNO_3$ - Silver Nitrate

33. $KMNO_4$ - Potassium Permanganate

34. $MgSO_4$ - Magnesium Sulfate (Epsom Salts)

35. HCl - Hydrochloric Acid

36. $NaCl$ - Sodium Chloride (Table Salt) (Saline is salt dissolved in water)

37. $HgCl_2$ - Mercury Bichloride

38. $NaBr$ - Sodium Bromide

XXIV. DRUGS

Drugs come in the form of solids (tablets, pills and capsules) and liquids. The dose of solid drugs in most cases is one tablet or one pill or one capsule. If you calculate the dose ordered to be several tablets, capsules or pills, there is (1) probably something wrong with your calculations; (2) you have misread the order or the size of the tablet on the label of the bottle.

Liquids are prepared so that 4 cc. (ʒi) contain the usual dose. Some liquid medicines are given in minum doses (i.e., gtt XV). If the medicine comes in a small bottle (℥i), it is probably to be given in minum doses. If it comes in a large bottle (℥vi or ℥xvi) it is most likely to be given in ʒi size doses.

A. Analgesics
1. Aspirin (Acetylsalicylic Acid) Tablet - .3 Gm. (5 gr.); Dose - .3 Gm. to 1.Gm. (5 gr. to 15 gr.)
2. A.P.C. Capsule - Dose - 1 to 2 capsules. (both 1. and 2. are given to ease mild pain, reduce high elevation of temperature and induce sweating).
3. Codeine Sulfate - Tablet - .032 and .06 Gm.; Dose - .032 to .06 Gm. (1/2 gr. to 1 gr.). (Given to ease pain, induce sleep and stop cough). It is a narcotic like Morphine Sulfate, but not so habit forming. It is used orally and subcutaneously.
4. Morphine Sulfate - Tablet - .016 Gm.; Dose - .016 to .032 Gm. (1/4 gr. to 1/2 gr.) (Given to ease severe pain, quiet restlessness, delirium and induce sleep). Depresses respiration and peristalsis, thus causing slow breathing and constipation; used orally and subcutaneously.

B. Sedatives and Hypnotics - (to induce sleep and relax nervousness - do not ease pain).
1. Phenobarbital (Luminal) - Tablet - .03 Gm. to .1 Gm.; Dose - .03 Gm. to .1 Gm. (1/2 gr. to 1 1/2 gr.). Elixir of Phenobarbital contains .016 Gm. (1/4 gr.) to the dram.
2. Nembutal, Amytal - Capsules - .1 Gm.; Dose - .1 Gm. to .2 Gm. (1 1/2 gr. to 3 gr.).
3. Bromides ($NaBr$, KBr, NH_4Br) - Tablet - .3 Gm.; Dose - .3 Gm. to 3. Gm. (5 gr. to 45 gr.). Elixir of Bromides usually contain 1 Gm. (15 gr.) to each dram.
4. Paraldehyde - Dose - 15 cc. to 30 cc.
5. Chloral Hydrate - Tablet - .3 Gm.; Dose - 1. Gm. (15 gr.)

C. Stimulants

1. Ephedrine Sulfate - Capsule - .025 Gm. and .05 Gm.; Dose - .025 Gm. to .05 Gm. (3/8 gr. to 3/4 gr.) (given orally and subcutaneously) Used as nose spray to shrink nasal membranes in a 1% solution.
2. Adrenalin or Epinephrine - 1-1000 solution - Dose - .3cc. to 1. cc. (5 m. to 15 m.) (given subcutaneously). Increased blood pressure, relieves asthma, increases heart, pulse and respiratory rates and is a general stimulant.

D. Depressants

1. Atropine Sulfate - Tablet - .0006 Gm. (.6 mg.) (1/100 gr) Dose - .0003 Gm. (.3 mg.) to .001 Gm. (1 mg.) 1/200 gr. to 1/50 gr. (given orally and subcutaneously). Depresses intestinal peristalsis, checks mucus flow, checks salivary flow, checks gastric secretion and dilates the pupil. Stimulates cerebral centers (as respiratory and cardiac center) Used with Morphine Sulfate pre-operatively to check mucus flow and counteract some of the depression of the Morphine on the cerebral centers.
2. Hyoscine Hydrobromide - Tablet - .0006 Gm. (.6 mg.) (1/100 gr.) - Dose - .0003 Gm. (.3 mg.) to .001 Gm. (1. mg.) 1/200 gr. to 1/50 gr. The action of this drug is much like that of Atropine Sulfate. However, it is a cerebral depressant and so is often used with Morphine pre-operatively to induce sleep, relax the patient, etc. The Technician must closely watch these patients who have had Hyoscine pre-operatively, for they often become mentally confused, delirious and can easily harm themselves while under the influence of the drug.

E. Bowel Evacuants

1. Cascara Sagrada - mildly irritates the mucosa lining of the colon to stimulate peristalsis.
   Fluid Extract of Cascara Sagrada - Dose - 2 cc.; Extract of Cascara Sagrada - Pill - .12 Gm.; Dose - 1 or 2 pills.
2. Castor Oil - irritates the mucosa of the small intestine to stimulate peristalsis - Dose - 15 cc. to 30 cc.
3. Mineral Oil - passes through the intestinal tract unchanged, and so acts as a lubricant and softens the feces. Dose - 15 cc. to 30 cc.
4. Magnesium Sulfate (Epsom Salts) - Dose - 15. Gm. with much water.

F. Malaria Drugs

1. Quinine Sulfate - Capsule or tablet - .3 Gm. (5 gr.); Dose - 2 to 4 capsules or tablets daily. Causes ringing in the ears, dizziness, mental confusion and deafness. If above symptoms are severe, reduce the size of the dose or stop the drug.
2. Atabrine - Tablet - .1 Gm. (1 1/2 gr.): Dose - 15 tablets taken 1 t.i.d. for 5 days.

<u>OPERATING ROOM AND SURGICAL TECHNIQUE</u>

TABLE OF CONTENTS

INTRODUCTION

The intention of this booklet is to present the problems involved in Operating Room and Surgical Technique. The greater the knowledge of these principles the Technician has, the better able he is to carry out necessary duties and assist in the operating room.

The various detailed routines in the way of equipment and procedures are largely based on past experience and information obtained from the best authorities on the subject. Fixed routines are not necessarily applicable to every patient or institution. Large permanent United States Army Medical Installations have naturally developed routines of their own and many of the smaller ones have neither the facilities nor the space for certain routines. Nevertheless, routines, as worked out in a prominent institution over a number of years, may be of considerable help in serving as a foundation or a comparison for other institutions. The routines given here have developed from the accumulation of work by various people over many years, but have been, and will continue to be, changed as circumstances and conditions require.

We are striving to teach you the ideal. Many of the principles set forth in this booklet will, of necessity, have to be modified when you return to your command. Remember, however, "Strive for the Ideal."

CHAPTER I

SURGICAL BACTERIOLOGY

Surgical bacteriology is one of the most important single subjects that is taught to the Technician. It is one of the subjects you must know before you can become a good Technician, so listen well and do not hesitate to ask questions.

Once the basic principles of surgical bacteriology are understood, it is not difficult for the Technician to understand the teaching of the practical application of these principles. If the subject is not understood, the Technician's mind will be in such confusion as how to perform many of his daily duties that he will be guilty of many errors in technique which may endanger not only his own life, but also the lives of his patients. Everyone associated in any capacity with the practice of surgery, must possess an alertness against bacteria which is almost automatic or reflex.

Technicians must study the principles of surgical bacteriology to learn:

1. How to prevent the growth of bacteria.
2. How to kill bacteria.
3. How to prevent bacteria from being transferred from one person to another.
4. How to prevent the entrance of bacteria into the body.
5. How to apply these principles of bacteriology to their everyday work.

BACTERIA

From the beginning of time, until the seventeenth century, little was known about bacteria. A Dutchman, Anton von Leeuwenhoek, in 1683, using a microscope of his own manufacture, was probably the first to describe living micro-organisms.

If we could trace back to their ultimate origin the development of all living things on earth of both animal and plant kingdoms, we would reach the minute, simple organisms consisting of a single cell. These are the lowest forms of life that exist on the earth.

For the purposes of study, these organisms have been divided into two classes or groups. The organisms belonging to the vegetable kingdom are called bacteria. Those belonging to the animal kingdom are called protozoa.

Bacteria then are minute, single celled, vegetable organisms, so small they can be seen only with the aid of a microscope, which magnifies or enlarges them 1000 times. Bacteria may occur alone or in large groups called colonies. However, each bacterium is completely independent. The terms, Microbe and Germ mean the same as Bacterium.

The bacteria with which we are concerned in surgery fall into two main groups:

1. Coccus (plural: Cocci) (kokkos = a berry). The round, spheroidal or ball-shaped bacteria.
2. Bacillus (plural: bacilli) (baculus = a rod). The rod-shaped bacteria.

Cocci

The ball-shaped group contain many of the bacteria which are characterized by the formation of pus (pyogenic bacteria). The chief members of this group can be classified roughly into two classes, according to the arrangement they always take when viewed with the microscope.

1. Staphylococcus (Staphyl = a bunch of grapes). These cocci group themselves in grape-like clusters and are the chief organisms which form thick, yellowish or white pus. Staphylococci are the cause of most boils, carbuncles, some infections of the fingers and hands, and "stitch abscesses" about a surgical wound.
2. Streptococcus (Strepto = twisted). Cocci which are arranged in chains or bead-like formation, and form a thin, watery type of pus. The streptococcus is to be expected in unclean surroundings, soiled clothing and dirty skin. Therefore, it is to be expected in the wounds of warfare.

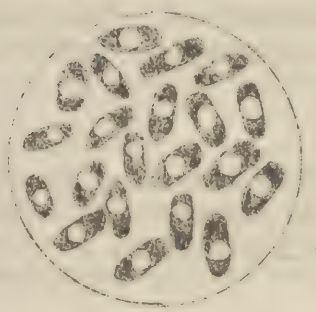
Bacilli

The rod-shaped organisms are likewise divided into two groups. The ones that are more frequently encountered following surgical wounds and combat injuries are:

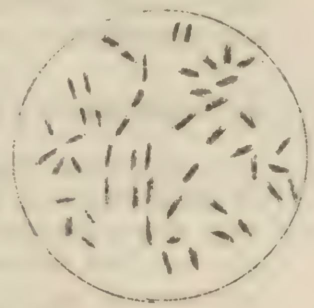
1. Bacillus Tetani - a non-pus producing bacillus, which causes the disease known as Tetanus (lockjaw). It is found in many soils and in the feces of horses, cows and human beings.

2. Bacillus Welchii - one of a group of bacilli which infect dead or dying tissues and is characterized by the formation of gas in them. It and its companions are found in cases of that dreaded wound infection, Gas Gangrene. These organisms are also commonly found in many soils.
3. Bacillus Coli - a large group of bacilli which normally live in the intestinal tract of the human being. This bacillus, commonly associated with intestinal wounds, produces a light brown pus with a fecal odor.

Bacillus Welchii



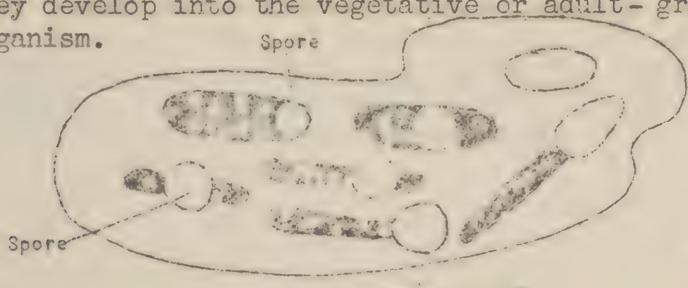
Bacillus Coli



4. Bacillus Pyocyaneus - a bacterium which produces green pus with a musty odor. It is found in intestinal discharges and is a secondary invader of chronic wounds containing pus. It is most often found in chronic discharges from the chest, the bones and the peritoneum.

REPRODUCTION OF BACTERIA

Bacteria may reproduce by a process known as fission or simple division. This means that one bacterium divides in 2 equal parts. Some organisms, of which the Bacillus Tetani and Bacillus Welchii are good examples, have the ability to form spores. These can be considered to be the seed or the reproductive element of the bacterium. These spores are much harder to kill by heat and chemicals than are other bacteria. When the spores enter the human body, they develop into the vegetative or adult-growing form of the organism.



Various sizes, shapes and positions of bacterial spores.

Bacteria also can be placed into two classes, depending on whether or not they can live in the presence of free oxygen.

1. Aerobic (aer = air + bios = life): Aerobic bacteria grow only in the presence of free air or oxygen.

2. Anaerobic (an = absence + aerobic): Anaerobic bacteria cannot live in the presence of free air or oxygen.

Most of the species of streptococci and staphylococci are aerobic. The Bacillus Tetani and Bacillus Welchii, however, are anaerobic. This is extremely important in the prophylactic and definitive treatment of war wound infections. These organisms may contaminate any deep, contused-lacerated, or punctured wound.

Distribution of Bacteria.

Bacteria flourish in moist surroundings at a temperature at or near that of the body. Under less favorable circumstances they may continue to exist, without multiplying, for long periods. All but the spore-bearing bacteria are usually soon destroyed however by sunlight and dryness.

These minute organisms then are constantly present in the air we breathe, the water we drink and the food we eat. Living things can make no contacts of any sort which do not expose them in some degree to bacterial contamination.

Certain varieties of bacteria, such as the common staphylococci and less frequently, the streptococci are to be found in the normally clean skin. Any wound of the surface may, therefore, be contaminated with either. The mouth, tonsils and throat harbor many sorts of bacteria, particularly streptococci. The intestinal tract, especially the colon, is loaded with bacteria, notably the Bacillus Colon Group and also the ever present streptococci. In some instances man picks up bacteria from contact with soil contaminated by animal discharges, as for instance, in the well manured farm land which harbors the anaerobic bacilli of Tetanus and Gas Gangrene. At other times, contamination seems to come from floating particles in the air - a phenomenon which forces the wearing of masks upon the staff of an operating room.

All bacteria do not cause disease. It is with the comparative few that do cause disease, termed pathogenic (pathos = suffering + gennae = I produce), that we are concerned. Approximately 250 living agents of vegetable and animal origin are known to produce disease in man. Of this total group, at least 56 are bacteria.

How Bacteria Cause Disease.

Under the ordinary conditions of health the human body is resistant to the action of the multitudes of bacteria. But let them gain entrance through a break in the protective covering of our bodies produced by injury, or let exposure, over fatigue, shock, hemorrhage, starvation or a constitutional disease, lower the natural resistance to their action, and infection occurs.

Finding warmth, moisture and food in the body tissues, the bacteria grow and multiply rapidly. Certain of these bacteria, as they grow, throw off highly poisonous substances which are taken up by the body and cause disease. This type of toxin is termed an exotoxin. The Bacillus Tetani is an example of a micro-organism, forming this type of poison. Other bacteria store up these toxic substances in their bodies, which are set free as they die and disintegrate. Such substances are called endotoxins. Some strains of Staphylococci and Streptococci are examples of micro-organisms forming this type of toxin or poison. These poisonous substances, toxins, when absorbed by the body, cause disease.

Contamination, Infection and Inflammation.

Contamination: The initial implanting or seeding of the bacteria into the wound, is termed "Contamination". What germs are present are apt to be concentrated in spots; here and there, on the surface or in the cavity of the wound.

Infection: For the first 4 or 8 hours an undisturbed contaminated wound may be expected to show little change. At the end of this time, secretions appear which spread the bacteria to all parts of the wound where they proceed to multiply rapidly, grow, invade the tissue beneath the wound surface, and give off their toxins. This invasion of the tissues of the body by pathogenic organisms in such a way as to favor their growth and permit their toxins to injure the tissues, is called "Infection".

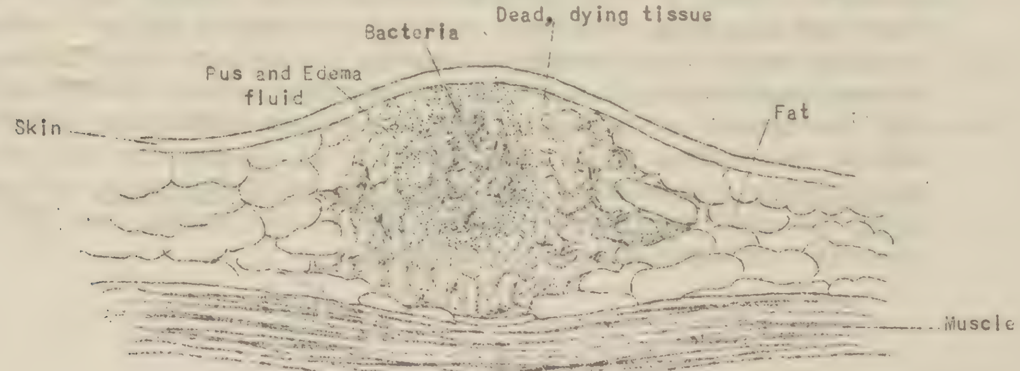
"Time Lag": The period between the contamination stage and the infection stage is spoken of as the "Time Lag" or incubation period. Every effort is made to treat war wounds before the "time lag" has elapsed. The duration of the period before infection becomes established depends largely on factors influencing the tissue resistance, i.e., (1) the potency of the bacterial toxins; (2) the number of bacteria and their aggressiveness; (3) the extent and degree of tissue damage; (4) whether or not one of the sulfonamide compounds (sulfanilamide, sulfathiazole, or sulfadiazine) is used orally and/or locally in the wound, and (5) the severity of any shock or hemorrhage.

Inflammation: can be defined as the condition into which tissues enter as a reaction to an irritation or injury. The injuring agent may be any one of several kinds. Bacteria, a blow, acids and caustic alkalies, heat and cold, and electricity, all are able to cause this tissue reaction. Bacteria are by far the most common and most serious of the injuring agents. If the tissue reaction to the invading bacteria is rapid in appearance, it is spoken of as an "acute" inflammation. When the tissue reaction comes on in a stealthy manner and is continued over a long period of time, the inflammation is said to be "chronic".

Local Symptoms of Acute Inflammation: most forms of acute inflammation with which we deal surgically are caused by bacteria. The cardinal local symptoms of an acute inflammation are redness, swelling, heat, pain and loss of function of the part involved. These local symptoms are caused by an engorgement of the small blood vessels of the injured area with a resulting increased blood supply, and an escape of blood serum and particularly, the white blood cells from these vessels into the surrounding tissues. The increased blood supply accounts for the heat and redness while the outpouring of blood fluids and cells accounts for the swelling, and by causing tension on the delicate nerve endings, pain is produced.

The white blood cells reaching the area, attempt to attack, kill and eat the offending bacteria. The blood serum which has escaped contains substances (antitoxins and anti-bodies, etc.) which also attempt to render the bacteria harmless. Usually the bacterial toxins are at first too much for the early defensive measures with the result that many white blood cells and local tissue calls are killed. These dead, white blood cells, dead and living bacteria, with the blood and tissue fluids around them, form what is called PUS.

Surrounding this area of dead cells, the body attempts to build a protective wall of closely packed tissue and white blood cells. This protective barrier must be respected by anyone dealing with an acute inflammation. When pus is enclosed by such a wall an ABSCESS is formed. This abscess, at first small, grows larger and if it approaches the unbroken skin, may appear as a small raised dot on the skin surface. The abscess is then said to have "pointed" or "come to a head". The surgeon will usually incise and drain an abscess without disturbing its protective wall.



ABSCESS: DIAGRAM OF TISSUE CHANGES (WOOLF)

Frank pus formation, with a rapid solution of tissues and a free outpouring of white blood cells, is usually caused by Staphylococci. Streptococci cause a more spread-out type of inflammation characterized by swelling and death of the affected tissues, rather than an abundant formation of pus.

General Symptoms of Inflammation.

The general or constitutional symptoms of an acute inflammation are caused by the absorption of toxic substances by the blood from the inflammed area. The usual symptoms are fever, increase in pulse and respiratory rate, headache, hot dry skin, flushed cheeks, loss of appetite, thirst, coated tongue, constipation and scanty, highly colored urine.

If the toxic absorption is rapid, there may be chills followed by sweating and even delirium.

Pus formation in the body almost always causes a multiplication of white blood cells. Normally in number from 6000 to 10,000 per cubic millimeter, the white cells may increase to 30,000, 40,000 or even to 60,000. The total count usually parallels the severity of the inflammation and the patient's natural resistance to disease.

Complications of Acute Inflammation.

Occasionally the defensive measures of the body are inadequate to overcome the infection. Consequently, we get absorption into the blood of a large amount of very poisonous products.

If only the toxins are absorbed, the condition is called a TOXEMIA.

When bacteria and their toxins are absorbed into the blood stream, we have a SEPTICEMIA.

If pus is discharged into the blood stream, a PYURIA has occurred.

The above complications are commonly called, by the layman, "blood poisoning". These conditions show the general symptoms of an acute inflammation with an increased severity. Chills, sweats and a temperature which shows abrupt rises and rapid falls one or more times daily are characteristic.

Repair of Wounds.

Wounds which are not contaminated by bacteria and are made with a minimum of tissue destruction, heal rapidly with little tissue reaction.

In cases in which pus formation (suppuration) has occurred, the process of repair is less simple and longer delayed. Gradually the dead materials are cast off and escape, and the wound cavity fills with a red, soft tissue which bleeds easily. It is composed of small, hair-like blood capillaries and fine fibrous

tissue strands, and is termed GRANULATION TISSUE. These fibrous tissue strands intertwine with each other to form the scar. The greater the delay in healing and the deeper and more extensive the granulation tissues, the more dense and contracted will be the resulting scar. Healing is complete when skin cells grow over these granulations. With loss of large areas of skin, healing will not take place and some type of "skin graft" must be done.

Occasionally two already granulating surfaces may be sutured together, the growing cells from the two sides blending and becoming organized into one scar. Large infected war wounds may be closed in this fashion ("secondary suture").

The presence of foreign material interferes with repair. Small metallic fragments, lead shot or even bullets may remain enclosed and harmless for an indefinite period. Larger or rough bodies are seldom tolerated, and since they most likely carry bacteria into the tissues, usually become a source of acute inflammation with pus formation.

CHAPTER II.

ASEPSIS AND ANTISEPSIS

The history of modern surgery really begins with the time when it was discovered that wounds could be made without the entrance of bacteria into them. As early as 1836 it was known that the decomposition of animal and vegetable tissues, a process termed PUTREFACTION, was caused by living micro-organisms and that this putrefactive process could be stopped by heat. It was not until the middle of the nineteenth century, however, that this knowledge was verified and put to some practical use. Louis Pasteur, the renowned French chemist, found that a nourishing fluid like broth, purified by boiling, would remain clear and pure for years if protected from the germ - and spore - bearing dust of the air, though it would putrefy if atmospheric dust could reach it. This principle has been widely applied and a method of partial heat sterilization is known today as PASTEURIZATION.

Before Pasteur's brilliant work most surgical wounds rotted and stank. Surgery was usually limited to amputation, procedures on the body surfaces and an occasional invasion of one of the body cavities. Surgery as we know it today with all its special fields, such as brain surgery, chest surgery and the intricate procedures of the plastic surgeon, was beyond the wildest dreams of members of the medical profession. The death rate following surgery of most any type, reached as high as 60 to 80 per cent. Surgical wards were rampant with infection. The pus of an acute suppurating surgical wound as it ruptured upon the surface of the body, was called "laudable pus", for its appearance marked a localization of the process, an escape of the inflammatory products and beginning of healing. In contrast to this were the common gangrenous, wide spreading putrefactions with the thin watery discharge that usually had a fatal ending.

It was Lister, an English surgeon, who in the period around 1865-1867, applied Pasteur's findings to surgery. Realizing that the bacteria were carried into the tissues by external contact, a treatment of contaminated wounds with solutions which were poisonous to the bacteria was instituted. These solutions were termed ANTISEPTICS. Carbolic acid (phenol) solution was selected as an antiseptic because of its known deodorant action upon sewage. Lister's expectations that attempted purification of contaminated wounds with carbolic solution and subsequent protection with sheet tin would do away with infection, was soon realized.

The next step was the development of an elaborate technic for operation on clean wounds, using carbolic solution on the patient's skin and wound, the surgeon's hands, and all the materials used at the operation. An attempt was made to destroy the germs in the surrounding air by the use of a carbolic acid spray.

It was Lord Lister who opened the door to the unlimited possibilities of modern surgical procedure. The main objection to Lister's ANTISEPTIC SURGERY was that the antiseptic solution purified the operative field, but also caused death of many tissue cells and prevented ideal healing.

With the advance of knowledge, it was found that the materials used in and about a surgical wound could be completely freed of all bacterial life, the adult vegetative organisms and even the hardy spore forms, by subjecting them to high temperatures (STERILIZATION). This protection of wounds, purposefully or accidentally made, against the invasion of bacteria was termed ASEPSIS. It became apparent that as each element which came in contact with a wound was freed from bacteria (Asepsis), the necessity for the use of chemical solutions (Antisepsis) in the wound itself was quite unnecessary. The ANTISEPTIC SURGERY of Lister's period gave way in favor of the newer and more efficient ASEPTIC SURGERY.

The Principles of Aseptic Surgery.

"The successful practice of aseptic surgery requires a strict observance of pre-operative sterilization of surgical materials, of rigid precautions against bacterial contamination during the course of the operation, and of guarding the wound from infection afterwards until such time as it is healed".

Pre-Operative (Before the Operation).

The procedures done before the operation consist of:

1. Killing <u>all</u> bacteria by heat or chemicals (STERILIZATION), on all surgical materials that are to come in contact with the wound or are to be handled by the surgeon and his assistants. These materials must be kept free of bacterial life (STERILE).
2. The preparation of the surgeon and his assistants and nurses before touching any of the above mentioned sterile materials. This preparation is termed "scrubbing up". While the hands and forearms are not rendered absolutely sterile, they can be made as clean as possible by scrubbing with soap and water, immersion in antiseptics, and the hands covered with sterile rubber gloves.
3. Covering the head and nose and mouth of each operator with a cap and mask. A long-sleeved sterile operating gown covers the non-sterile light clothing worn by the operating personnel.
4. "Preparing" the operative area by removing hair, surface fats and dirt and the application of a chemical agent to render the bacteria harmless.

5. Covering the rest of the patient's body, other than the operative site, with sterile coverings as drapes.

During the Operation.

The surgeon and his assistants touch nothing that has not been rendered and kept sterile (free from bacteria). Non-sterile assistants do not touch and contaminate anything that is sterile.

Post-Operative (After the Operation).

The wound is protected from possible bacterial contamination by means of sterile dressings. Care is taken to prevent contact of anything that is not sterile with the unhealed wound.

ANTISEPTICS

Sepsis (decay): Poisoning by the products of a putrefactive process.

Antiseptic: A chemical agent which prevents the growth of bacteria without necessarily destroying them.

Germicide: Any agent that kills bacteria.

Disinfectant: An agent, usually a chemical, which destroys pathogenic (disease-producing) bacteria.

Antiseptics are used in surgery under three main sets of conditions: (Eliason).

1. Application to the skin. "Antiseptics are applied to the skin in a wide area about the operative area to destroy its normal and accidental bacterial inhabitants, and so prevent the entrance and development of infection from the source in the operative wound".

2. Application to the Tissues. Antiseptics are occasionally applied to tissues which are contaminated with bacteria or infected with the object of assisting the normal resisting powers of the tissues to destroy the germs and their products. An ideal antiseptic would be one that rendered the open tissues free of bacteria without causing damage to the tissue cells. However, to date, the ideal antiseptic has not been introduced. Most of the better known antiseptics in killing the bacteria, also tend to destroy the body tissue cells. The use of antiseptics in dealing with contaminated tissues is rapidly falling into disfavor. The use of the sulfonamide drugs (sulfanilamide, sulfathiazole and sulfadiazine), locally in contaminated wounds, does prevent the

growth of bacteria, however, without the deleterious effects of the antiseptics. Every soldier will carry 5 grams of crystalline sulfanilamide for the above purpose.

3. Chemical Sterilization of Instruments and Surgical Materials (to be discussed in Chapter IV).

The more common antiseptics (some have mild germicidal powers) used on the skin in surgery are:

a. 70% alcohol - alcohol causes pain when applied to open wounds and irritates mucous surfaces (eye, urethra, etc.).

b. Tincture of Iodine - 3 to 7% solution. Iodine solutions often irritate the skin. It is never used on wet surfaces, the palms, soles, armpits, or perineum. If the patient is perspiring, iodine should not be used on the face, scrotum and other tender parts of the skin. The iodine is allowed to dry and then removed with 70% alcohol. The bottle should be tightly corked and the solution renewed frequently.

c. Tincture of Merthiolate - an alcohol-acetone, colored (pink) solution for skin preparation. Water (aqueous) solutions of merthiolate, 1:1000 to 1:10,000 are also used occasionally in wounds and for irrigations of various parts of the body (bladder, kidney, etc.).

d. Tincture of Mercretone - a colored mixture of alcohol, acetone, cresol, bichloride of mercury, water and acid fuchsin.

e. Metaphen - a yellow solution of a crystalline compound of mercury with cresol.

The most important point in operating room technique is absolute cleanliness and adherence to the principles of asepsis on the part of <u>everyone</u> concerned. The personnel of an operating room, either in a fixed or field installation, functions as a team and a "break" in technique by any one member of this team ruins the final result, which is, of course, a successful operative procedure followed by rapid healing of the wound.

Remember, never be afraid to admit that you have "broken technique", i.e., contaminated the sterile materials or contaminated yourself, if you are sterile.

CHAPTER III.

OPERATING ROOM AND EQUIPMENT

The operating room is really the center of surgical treatment. The patient is in the operating room for only an hour or so, but whatever is done there may forever affect his life, health and happiness. For this reason every available effort should be made to save time and effort during the operation and reduce the risk as far as possible.

The Technician working in the Operating Division should have a good understanding of aseptic and antiseptic surgery and above all must be a man of great carefulness, conscientious in details. As you remember, you were told that surgical infections usually come from contact with something that is not surgically clean and not from the surrounding air.

The operating room itself should be clean and free from dust. The floors, ceiling, windows and doors of an operating room are usually so constructed that they will admit and retain the least amount of dust and permit easy cleaning. The room must be disinfected frequently and no dusting must ever be permitted. The proper procedure is to mop the floors and wipe the walls with cloths moistened in some disinfectant or germicide.

Ventilation should be adequate but care should be taken that there are no draughts. An even temperature from 72°F. to 80°F. should be maintained. Although this may seem a bit warm to you who have outer clothing, remember that the patient is quiet and relaxed, parts of his body exposed and other parts covered so that he may perspire and chilling must be carefully avoided. Some cases of pneumonia which have developed following an operation have been due, no doubt, to faulty ventilation in the operating room during the operation. Maintaining the proper humidity or amount of moisture in the air, will make conditions more pleasant for all.

Equipment:

The operating table and the large overhead lights are the hub about which all activity in the operating room revolves. Various types of tables are in use but the ones that can satisfactorily be adjusted to the surgeon's needs with the least discomfort to the patient, is the most efficient. The only way to learn the workings of an operating table is to work on it personally. I hope that each of you avails himself of the opportunity to become thoroughly familiar with the operating table. Learn the various positions required for the different surgical operations and how to get the patient into those positions with the least disturbance to him and to the operating team. It is very annoying to the surgeon to have someone fiddling around with the operating table instead of obtaining the proper position in the shortest amount of time.

The artificial light is a very important piece of equipment. It should provide a maximum of light and a minimum of heat and be easily adjustable. Learn too, how to adjust the light. Nothing will gripe the surgeon quicker than to have someone inexpertly manipulating his light while he is operating. The light should be focused in such a way, and protected, that there is no glare reaching the eyes of the operating team.

There are usually two instrument tables: The larger one for reserve and extra instruments, needles, solutions, etc., and the smaller one containing the instruments for immediate use. The larger table (10 x 3) is placed off to the side of the operating team. In this hospital the Technician carries sterile supplies, instruments, etc., from the reserve table to the smaller instrument table with the aid of sterile "pick-up" forceps. Another technique is to have the reserve instrument table close enough to the operating table that the scrub-nurse can get her own sterile reserve instruments and supplies. The smaller table is adjustable in height and the top will slip over the table and patient so that the instruments are within easy reach of the operating team. This table can be adjusted or moved easily any time it is necessary to change the position of the patient.

There is also a moderate sized table (5 x 3) on which are placed the sterile gowns and gloves for the operating team.

There should also be at least two waste basins or pans on the floor, preferably in standards on rollers, to receive the soiled sponges and towels. It is best to have at least one waste basin on either side of the operating table for the convenience of the surgeon and his assistants.

An immersion or "splash" basin containing sterile water should also be placed on each side of the operating table. In this the surgeon and his assistants will cleanse their gloved hands of blood and fats, etc. These splash basins are usually contained in waist-high standards, preferably on wheels.

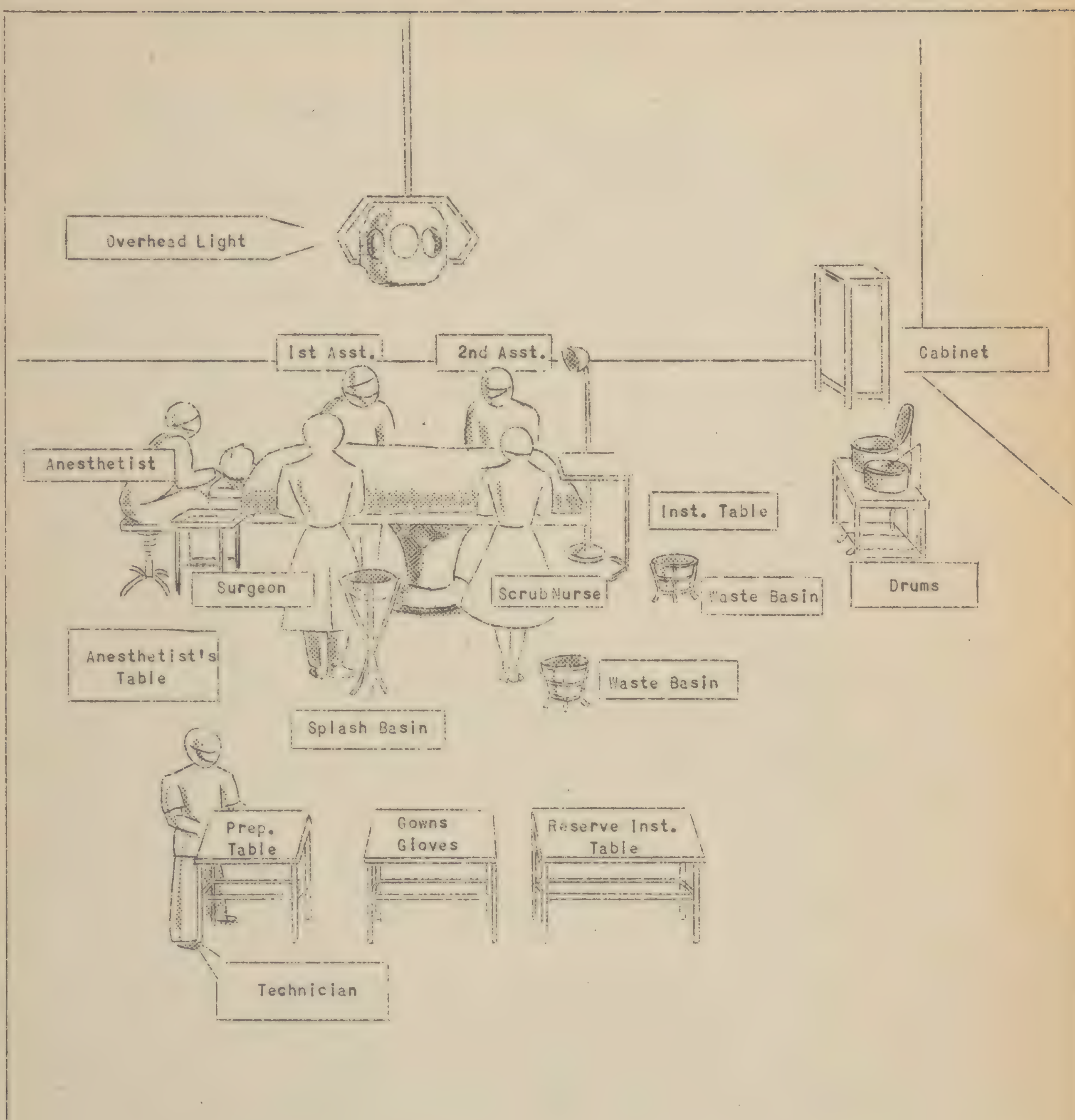
A small preparation table is helpful, containing the necessary solutions and instruments for preparing the field. This table is removed from the operating room as soon as the preparation is completed.

A small table is provided the anesthetist for his small amount of equipment. A stool is also provided the anesthetist.

Adequate cabinet space is provided for wrapped sterile supplies and the unsterile supplies such as adhesive, bandages, bandage scissors and plaster.

Low benches varrying in height and length are required for the use of the team. The table may not be sufficiently adjustable, the patient may be very large, or the surgeon or other members of the team may be short, so that one or more will require a bench to stand on to make the operative field more accessible for him.

Off to one side of the operating room there are usually standards to hold the drums in which towels, gowns and other supplies have been sterilized. These drums are circular metal containers


Overhead Light
1st Asst.
2nd Asst.
Cabinet
Anesthetist
Inst. Table
Surgeon
Scrub Nurse
Waste Basin
Drums
Anesthetist's Table
Waste Basin
Splash Basin
Prep. Table
Gowns Gloves
Reserve Inst. Table
Technician

with a double side in which there are perforations. These perforations are open when the drum is in the sterilizers to admit the steam, and closed when the drum is removed from the sterilizer, by sliding the adjustable side, and keeping the contents sterile. When these drums are in use in the operating room, there is a lid attachment on the standard which permits opening and closing the top on each drum by means of a foot pedal. The Technician brings the drum from the sterilizer and places it in the standard.

Before the Operation:

The operating room and furnishings are not sterilized, but are washed at regular intervals and wiped off each morning. After certain operations, especially those where streptococcus infection is present, the floors, cabinets and other furnishing ordinarily left in the room are scrubbed with cresol solution. The overhead light is cleaned by the surgical technician every morning as it is directly over the operative field and dust can filter down especially if the light is adjustable and is moved during the operation. The entire fixture, including exposed wiring, is cleaned with a cloth moistened with a germicide or disinfectant and then dried and polished with a dry cloth. At intervals the inside of the light is cleaned to remove the dust collected there, which would interfere with the free passage of the light rays.

The room has been previously cleaned and the Technician should check to see that there is no collection of dust on the furniture, window sills or equipment. After the room has been set up for operation, all empty wrappings, containers and other unnecessary articles should be removed.

The setting up of the various tables is done before the operation. As far as possible the tables for the succeeding operations are set up the first thing in the morning to avoid delay between operations. (Where instruments have to be used again for the next operation, all but a few can be removed when the surgeon begins to close the wound so that they can be sterilized and ready for the next patient).

After the Operation:

Planned cleaning and clearing of the room will save considerable time:

1. Tables are stripped, cleaned and dried.
2. Empty or contaminated articles stacked on nurse's tables, ready to be taken out.
3. Floor basins emptied into one basin and this removed.
4. Used linen placed in the linen hamper which is removed from the operating room to a room where the linen can be properly sorted and cared for.
5. Lights are turned off and all electrical apparatus is disconnected.

6. Instruments are collected in a pan, put in the sink and washed with running cold water. They may be then autoclaved for ten minutes (10), scrubbed, dried and lightly oiled or in some hospitals, the autoclaving is omitted.

7. Sterile and unsterile supplies are checked and insufficient or missing articles are replaced. The dates on the sterile supplies are checked and those over five (5) days old are removed to be resterilized.

Additional Equipment:

Besides the standard operating room equipment, special types of operations will require additional equipment.

Thyroid Cases: In addition to standard equipment, there should be a special thyroid sand bag, long enough to reach from shoulder to shoulder, and a special ether screen which permits better access to the neck.

Chest Cases: The patient's position will be such as to prevent use of the usual arm restraint so two hand ties are prepared.

Additional Articles Needed:

2 large pillows	Shoulder brace with attachment to adjust parallel to table.
2 small pillows	Special ether screen and special foot screen.
Medium sized sand bag	

Kidney Cases: In addition to standard equipment:

Universal table shoulder brace
Kidney back rest
Crank for kidney break or elevator
Two hand ties
One large pillow
Two anesthetists rolls
One long sand bag
Two small pillows
Roll of 2 inch adhesive.

Orthopedic Cases: The equipment will depend on the region to be operated upon, the type of operation and the position required for the operation. For the lower extremities, the patient is usually horizontal and the sandbags of various sizes are used to elevate the field to the necessary height or position. If it is an arm or hand operation, an arm board covered with rubber sheeting and pillow case is prepared. If the operation is on the spine, then a prone position or a jackknife position is used, and for this are needed:

Two anesthetist's rolls
One large pillow or additional small pillow
Two hand ties

Neurosurgery: No preparation is done until the patient is brought to the anesthetizing room. If it is a head case the hair is clipped and the scalp shaved, and the area is sponged with green soap and water and alcohol.

1 set of sterile scrub basins
2 packages of sterile sponges
1 flask of sterile green soap
1 flask of sterile water
1 flask of 70% ethyl alcohol
2 straight razors
1 electric clipper
1 large floor basin

The type of table required for neurosurgery will depend on the operation, as to whether it is a cerebellar, cerebral, or spinal case. The head cases will require a special head rest and shoulder braces. Operations utilizing the upright position will require a special operating chair or table with a special head rest attachment.

The operating room itself is just one of the many rooms which usually go to make up the Operating Division. In the majority of hospitals more than one operating room proper will be found. Grouped in the Operating Division in strategic places we find a dressing room for surgeons and a dressing room for nurses and one for technicians. In these rooms the street clothes are changed for the conventional operating room garb. Close by the operating room is the scrub-up room in which the surgeon and his assistants and the sterile or scrub nurse cleanse their hands preparatory to putting on their sterile gowns and gloves. This room contains wash basins, soap containers, sterile brushes and caps and masks. The work rooms for the technicians in which all linen is wrapped, gloves washed and packed, instruments cleaned postoperatively, solutions prepared for sterilization, etc., is in the Operating Division. Also contained in this area is the larger Sterilization Room in which most of the supplies are rendered aseptic. Each operating room may have a small adjoining room containing a small electric water sterilizer or autoclave. It is here that resterilization of instruments, rubber drains, etc., can also be accomplished here.

Larger hospitals have an Anesthetizing Room into which the patient is brought from his room or ward. Here, away from the clatter of instruments and other exciting noises, the patient is put to sleep and then transported into the operating room. Some men feel that it is unwise to surround the operating room with an air of mystery, thus leading the patient to think it is a horrible sight and that he cannot be taken there until after he is asleep. Feeling that the modern operating room is interesting and attractive and a view of it encouraging to the patient, some doctors administer the anesthetic in the operating room proper.

CHAPTER IV.

SURGICAL STERILIZATION

Sterilization is the destruction of all bacterial life, both pathogenic and non-pathogenic. Not only the vegetative forms which are easily killed, but the vitality of the spores must be destroyed so that there will remain no possible chance of immediate or remote growth at the seat of the operation.

The problem of sterilization of surgical instruments and supplies should resolve itself into one of real sterilization and not of relative sterilization, as commonly practiced. We have the means at hand now of destroying the most resistant germs and their spores, but at times, we grow careless or develop a false sense of security because average, but somewhat lax, procedures seem to meet average requirements. Adequate equipment should be on hand and there must be a definite knowledge of the fundamentals. Without these any sterilizing performance will include an element of danger. We should always provide for sterilization that is adequate for the unusual occasion even at the sacrifice of economy and speed.

Heat in one of its various forms provides the only means of actual sterilization. However, other methods of sterilization used today are mechanical, chemical and physical.

Mechanical Cleansing.

No mechanical means can absolutely rid a surface of all bacterial life so it should not be called sterilization. However, a thorough scrub with a mild soap or deturgent, will remove from the skin great numbers of the organisms present on its surface. This procedure is applied to cleanse the operative area, the hands and forearms of the surgeon and his assistants and technicians, and occasionally in preparing a recently contaminated wound for operative procedures (debridement or wound excision).

Sterilization by Chemical Agents

Chemicals were the first agents used for destroying bacteria in the operating room. The effectiveness of these agents depends upon the chemical used and its strength. In many cases they do not insure complete sterilization, but merely produce a partial or temporary arrest of the activity of the bacteria contained on the materials. No doubt there are chemicals which, if maintained at proper strength, will serve for sterilization of delicate instruments, but modern aseptic surgery with its emphasis on prevention, requires sterilization by adequate thermal (heat) methods whenever possible. Avoid chemical sterilization

whenever possible. It is now possible to sterilize practically all types of instruments, previously sterilized in chemicals, in a pressure steam sterilizer with no apparent injury.

A few of the common chemical agents used to sterilize instruments are listed below:

1. 70% alcohol (by weight) (81.5% by volume). Contrary to popular belief, 70% alcohol is not a good sterilizing agent.

2. Cresol - a saponated solution containing 50% Cresol and 50% soap solution. This solution is dark and sticky and is usually mixed with 70% alcohol, using 70 parts of the saponated Cresol Solution and 30 parts, by volume, of 70% alcohol. Instruments sterilized in this solution must be washed off in 70% alcohol before being used on the body or handled by the sterile personnel.

Time Limitations: 30 minutes for clean instruments, or instruments used in a non-infected "clean" case. This is the minimum. 60 minutes for instruments used on an infected or "dirty" case. It is better to autoclave these instruments whenever possible. 18 hours for instruments used in cases of gas gangrene or tetanus. The only real safe method of dealing with instruments and materials contaminated with the spore-forming bacilli of tetanus and gas gangrene, is pressure steam sterilization.

3. Mercury Oxycyanide - used in a 1:500 or 1:1000 solution. This is the common chemical used by the urologist to "sterilize" his cystoscopes, etc. It does not produce complete sterilization, but is the best chemical available for the purpose.

15 minutes is the minimum time required while a period of 30 minutes should usually be used.

4. Phenol (Carbolic Acid) - occasionally used in a 2% to 5% solution. Time is the same as that given above for Cresol. It is occasionally used in the sterilization of sutures.

5. Bichloride of Mercury (Mercuric Chloride) - is a white crystalline substance that gives a clear solution in water. For hospital use it is commonly colored with a dye. It is extremely poisonous. The tablets in common use contain 0.5 gram of bichloride of mercury. One of these tablets added to a pint (500 cc.) of water makes a 1:1000 solution which is a cheap and fairly effective antiseptic. Metal instruments are corroded by bichloride of mercury.

Heat Sterilization

Man has used heat as a sterilization agent for hundreds of years. It was an ancient custom to pass knives through a flame to purify them. Dry heat, in the form of hot air, was an agent employed by primitive man for drying food when there was a great abundance and thus preserving it until a time when it became scarce and difficult to secure from the natural sources of supply. The processes were not even thought of as processes of sterilization; but in reality they were the beginnings of our present day processes of heat sterilization. Early workers demonstrated that heat, in its various forms, was a very effective agent for destroying the bacteria which caused infections and disease. Since that time it has been the agent most commonly used, and has been applied in the form of the flame, hot dry air, boiling water and moist heat or steam, with or without pressure.

Sterilization by Flame

The actual flame is the most effective, but due to its destructive properties, is the least used of all the agents for securing surgical sterilization.

Sterilization by Dry Heat

Dry heat sterilization is carried out in hot air ovens. It is, in fact, sterilization by hot air. Its most common use is in the laboratory, for the sterilization of glassware, cotton batting and similar materials. This method sterilizes by heat alone and obviously is applicable only to those products which are not destroyed by heat. This method also excludes water and any water contained in the articles is promptly driven off, as steam.

Surgical supplies, such as vaseline, oils, bonewax and bulk talcum powder, should be sterilized by dry heat, rather than with steam under pressure. This statement permits discussion, since in the majority of hospitals vaseline and oils are sterilized by pressure steam with more or less success. The point is that bacteria and spores buried in oil or vaseline are shut off from the moisture of the steam, and the heat alone absorbed by these products can never rise in any normal pressure steam sterilizer, to a temperature sufficient for dry heat sterilization. The maximum temperature of the autoclave should never exceed 250°F., and at this temperature an exposure of many hours would be needed to destroy the spores. That greater difficulty is not experienced in the use of such products, incompletely sterilized, is accounted for in the probability that the substances do not promote the growth of bacteria, and are commonly secured in nearly, if not quite, sterile conditions from manufacturers.

For the above requirements the hot air oven is used in which the temperature is maintained at 300 - 350°F. for an hour or more.

Sterilization by Moist Heat

Sterilization by moist heat is the method that is now used in most hospitals for securing the necessary sterile supplies for surgical use.

Moist heat is more penetrating than dry heat, not so destructive of the materials and substances to be sterilized and effectively kills disease-producing bacteria in a very much shorter time. It may be applied in the form of:

1. Boiling water
2. Freely flowing (atmospheric) steam.
3. Steam under pressure

With boiling water and freely flowing steam the temperature never rises above 212°F. Much higher temperatures can be secured through the agency of steam under pressure.

Atmospheric Steam Sterilization - this means the unconfined (not under pressure) steam from boiling water as employed in the Arnold sterilizer. It has been repeatedly shown that although free steam will destroy all vegetative forms of the pathogenic bacteria, some spores will withstand this steam, (never greater than 212°F.) for many hours of continuous exposure. Obviously for surgical purposes, it has no value.

Pressure Steam Sterilization - The bacteria destroying power of steam is composed of two factors, both of which are essential: (1) heat and (2) moisture. Heat is actually the destructive factor, but the moisture acts as a necessary conductor for the heat. The presence of this moisture also explains why saturated steam is preferable to hot dry air. The steam contains moisture, while hot dry air drives off moisture and dehydrates the material.

The purpose in using steam under pressure is to develop higher temperatures than can be obtained without pressure. Pressure of itself has nothing to do with the destructive factor of steam. As pointed out above, unconfined steam, i.e., steam at atmospheric pressure, does not provide complete surgical sterilization, so sterilization of surgical supplies is attempted only at the higher temperatures of pressure steam. The temperature range from 240°F. to 254°F. is considered as adequate for good surgical sterilization.

We cannot readily measure the amount of moisture in steam but we can and do measure the temperature of the steam, and that is the factor around which the efficiency of the sterilizer hinges basically. If the sterilizer is working properly, the temperature of the steam is held within certain defined limits by regulation of the pressure, but under no circumstances should the pressure

factor be used as the gauge of sterilization, because it does not always follow that adequate sterilizing temperatures will result from pressures represented to be adequate.

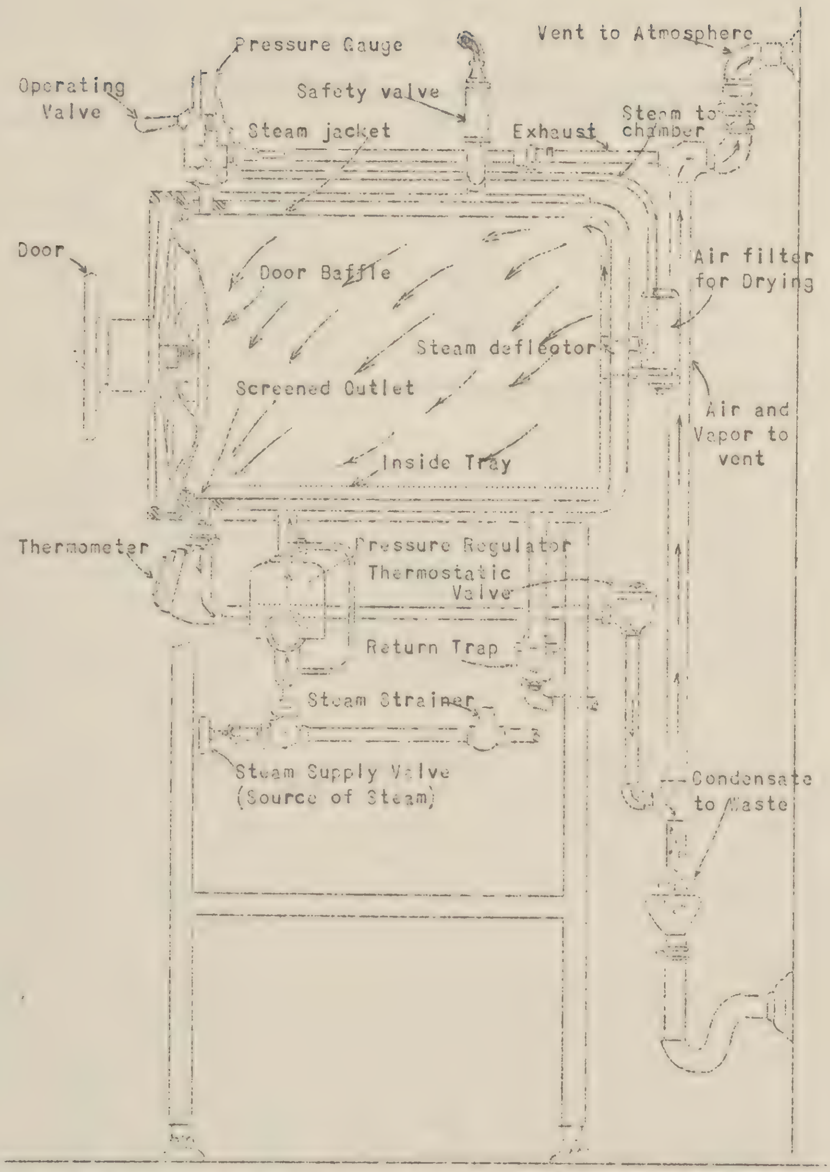
How Penetration of Steam Occurs - all surgical materials to be sterilized should be classified as either porous or non-porous. Examples of the former would be gauze, muslin covers and drapes and surgical gowns. Surgical instruments and metal utensils are good examples of non-porous articles. Briefly, steam sterilization implies for all porous substances, complete penetration and permeation with steam, or for non-porous substances, actual "surface contact" with steam.

Steam heats anything that it contacts by a process of condensation in which moisture is left in or on the materials, exactly equivalent in quantity to the amount of the heat absorbed from the steam. If not obstructed by air, contained in the sterilizing chamber, the entire mass will heat to the temperature of the steam. If the steam is obstructed by air, serious handicaps to sterilization will arise. Most of the failures of an autoclave to turn out sterile materials are usually due to incomplete expulsion of air from the sterilizing chamber. No two substances can occupy the same space at the same time, so the air must be pushed out before the steam can occupy its place. Air is contained in the chamber, between the packs and inside the packs themselves. All air must be expelled before steam can occupy its place and penetrate to the center of the pack.

The presence of air in the sterilizing chamber will prevent the temperature in the chamber from reaching that degree of heat which corresponds to the steam pressure indicated by the pressure gauge. When air and steam occupy the same chamber, the total pressure in the chamber is equal to the sum of the partial pressures of both the steam and air present - but, the temperature will correspond to the partial pressure of the steam only.

Total pressure = steam pressure + air pressure.
Total temperature = temperature corresponding to steam pressure only.

For example, if all air is not removed from the sterilizing chamber and steam is allowed to enter it, until the pressure gauge registers 18 pounds (figure given in books as adequate pressure for sterilizing), this 18 pounds of pressure is not all steam pressure, but that 6 pounds are due to the air present and that 12 pounds are produced by the steam. The temperature then would correspond, in proportion, to the 12 pounds of steam pressure and would be inadequate for surgical sterilization. This proves the mistake of depending upon pressure as a criterion for sterilization, rather than temperature. The sterilizing effect of the steam and the period of exposure are based upon the attainment of adequate sterilizing temperature in the coolest part of the chamber.



LONGITUDINAL SECTION OF MODERN STERILIZER. STEAM IS DELIVERED FROM THE SOURCE TO THE STEAM JACKET, THROUGH A PRESSURE REGULATOR WHICH AUTOMATICALLY MAINTAINS THE DESIRED RANGE. THE SAME PRINCIPLE APPLIES FOR STEAM HEAT (AS INDICATED) OR FOR GAS OR ELECTRICALLY HEATED STERILIZERS.

The actual temperatures attained in the pressure steam sterilizer under ordinary conditions of <u>proper</u> and <u>improper</u> usage are given in the following table

TABLE I.

Temperatures with Various Amounts of Air Discharge

Gauge Pressure in Pounds	Pure Steam Complete Air Discharge	2/3's Air Discharged (20" vacuum)	1/2 Air Discharged (15" vacuum)	No Air Discharged
	DEGREES FAHRENHEIT			
5	228°F.	212°F.	202°F.	162°F.
10	240	228	220	193
15	250	240	234	212
20	259	250	245	228
25	267	259	254	240
30	275	267	263	250

The pressure steam sterilizer consists essentially of an outer metal cylinder and an inner metal cylinder forming a steam jacket,the whole closed with a tight-fitting door. It is provided with pressure gauges, an operating valve, a safety or "pop off" valve, a thermometer, thermostatic valve, an exhaust line with a waste trap, a steam supply system, with a pressure regulator, and a removable tray for loading. (See diagram of Pressure Steam Sterilizer)

With the modern temperature controlled pressure steam sterilizer, the air is evacuated by the gravity method. The steam may be supplied from a central point as in our larged fixed hospitals, or by water heated to the boiling point by a gasoline stove, provided to field outfits. When the steam is admitted to the chamber, after the steam jacket has been pre-heated, the air, being twice as heavy, will gravitate to the lower areas. The steam floats to the top of the chamber, and not readily mixing with air, exerts a blanketing effect to compress the air downward. The flow of steam is also always downward. The air continues to flow from the bottom screened outlet of the inner chamber, through the thermometer chamber and the thermostatic valve to the vent, until hot steam finally follows the air and causes the thermostatic valve to close. Thereafter, the thermostatic valve will only open briefly to discharge cooler condensate and air pockets as they gravitate from the contained supplies to it.

Method of Operating Pressure Steam Sterilization:

1. Clean out the strainer on the inside of the sterilizer at the entrance to the discharge outlet. Remove all lint, shreds of cotton and sediment until the pores of the screen are open.

2. Turn on heat and secure jacket pressure of 15-17 pounds. Place load in sterilizer, close and lock door.

3. With jacket pressure 15-17 pounds, turn operating valve to "sterilize" - admit steam to the sterilizing chamber.

If the discharge system is unrestricted, the temperature shown by the indicating thermometer (and the recording thermometer, if one is used) should advance gradually to 250-254°F. Timing of the period of exposure can safely be made as soon as this temperature has advanced to 240°F. The interval of time needed to build up to this temperature should be about 2-4 minutes. This temperature will never be attained unless the discharge system is sufficiently free for the evacuation of essentially all air.

If the temperature does not advance to 240 degrees within a period of 2-4 minutes, the sluggish action may be due to a partial clogging of the screen in the entrance to the discharge outlet in the bottom of the sterilizer. If this screen is clear, then there will usually be found a sticky mass of sediment mixed with glucose or vaseline, which has accumulated in the thermostatic valve, which should, of course, be cleaned out. This sort of stoppage should occur only at long intervals. The sluggish action may be due to a fatigued condition of the thermostatic valve, in which case the valve element should be renewed, or a new valve substituted.

If the temperature does not advance to 240 degrees at all, that is definite indication of a badly clogged discharge line, or the fault may be found in a defective thermostatic valve. Under no condition should attempt be made to use the sterilizer at all, unless the discharge line temperature has advanced to 240 degrees before timing the period of exposure.

If the discharge line temperature advances barely to 240 degrees F. when the pressure is maintained at 15-17 pounds, check first the accuracy of the chamber pressure gauge. If this seems to be correct, the interruption will probably be due to a faulty thermostatic valve - one of those which closes off too soon. It should be promptly replaced. Temperatures should advance within 4-8 minutes to approximately 250-254 degrees F.

4. Time the period of exposure when the thermometer indicates 240°F. Check this point with the mercury thermometer, then the recording thermometer, if one is provided. Care should be taken to regulate the heat control so that the jacket pressure is dependably maintained at 15-17 pounds throughout the sterilizing period.

5. The Recommended Periods of Exposure will be discussed in the next chapter.

6. At close of period of exposure for all materials except solutions (do not turn off heat until goods are ready to remove from chamber), turn operating valve to exhaust chamber pressure. When chamber gauge shows zero pressure, turn operating valve to "vacuum" position for 3 minutes, then turn operating valve to "off" and open vacuum breaker valve. (Some sterilizers automatically control breaking of vacuum when the operating valve is turned to "off"). As soon as the chamber gauge shows zero pressure, unlock the door but do not open it, merely loosen it slightly - just enough to permit vapor to escape. Leave the door "CRACKED" in this manner for 5 minutes for light loads, or 10 minutes for heavy loads. Then open the door and remove the goods. The heat may now be turned off unless another load is to be sterilized at once.

7. At close of period of exposure for all solutions, leave the operating valve at "sterilize" just as during the period of exposure. Turn off all heat. Wait until the chamber gauge shows zero pressure. Then only, open door and remove flasks.

<u>Limitations and "Period of Exposure"</u> - the period of exposure should be timed as beginning when the thermometer registers 240°F. Actually the temperature in the chamber is about 5° higher for the thermometer is at the coolest place in the system - the discharge line.

The one regulation range for every surgical sterilization performance is fixed at 250-254°F. maximum temperature, as indicated by the thermometer.

The above temperatures (250-254°F.) correspond to 15-17 pounds actual steam pressure. These pressures should be automatically maintained. The interest of the operator should be centered on the maintenance of the temperature as measured by the thermometer ("discharge line temperature") which is indicative of the two essential factors: (1) that the air discharge system (outflow) <u>is</u> or <u>is not</u> functioning properly; (2) measurement of the temperature of positively the coldest medium surrounding the load (materials in chamber) - and keeping that temperature within the prescribed safe range.

Care of Pressure Steam Sterilizer - A thorough inspection of all gauges and valves should be made by the Engineer of the hospital at regular intervals, to keep all sterilizing accessories working at their highest efficiency. Steam pressure gauge should be gauged occasionally against the standard gauge for the gauge that is known to register steam pressure correctly. If they are found to be registering incorrectly they should be repaired immediately or replaced with new gauges. The Pop Valves should always be checked against steam gauges that are in good condition. They should be set to blow off at a steam pressure of 20 to 22 pounds. Any adjustments of the Pop Valves should be made by an Engineer. These precautions must be taken, otherwise a situation is likely to be created that may endanger the safety of those operating and working near the sterilizer. Such care and attention will contribute greatly to the satisfactory service rendered by the sterilizing equipment of any hospital.

The usual cause for interruption to the thermostatic controlled pressure steam sterilization has been found to be the clogging of the discharge line with sediments. A thin film of fine shreds of cotton over a screened surface will shut off almost completely the flow of air. Some provision should be made to prevent clogging at some inaccessible point such as the opening of the thermostatic valve. A large, fine meshed screen should be placed on the inside of the sterilizer. This can be easily taken out without tools and cleaned daily. Should the thermometer fail to indicate the desired range of temperature, when proper pressure is applied, that will show the operator that the cleanout screen needs cleaning. This is done immediately. It also may mean that the thermostatic valve has frozen shut or is broken. In any event, failure to attain the prescribed temperature indicates a fault which must be fixed before attempting surgical sterilization.

Sterilization Detectors - (Diack Controls) - when an apparently normal performance of a pressure steam sterilizer fails to produce sterile results, the trouble may be traced usually to one or more of three sources, (1) faulty performance of the machine; (2) careless handling of the machine; (3) careless preparation and loading of materials. The use of incompletely sterilized goods will endanger patients' lives, so the defect must be detected before the goods are used.

The most practical and safest form of sterilization detector is the Diack Control. It consists of a tablet of chemical substance, hermatically sealed (air driven off) in a very small glass tube. It is not subject to any change whatsoever, except temperature. The tablet fuses, or melts - changes shape - if exposed to temperature of 250°F. for 2.8 to 3.2 minutes, or at 246°F. for 27 to 35 minutes. At 242°F. it was not found melted after 150 minutes of exposure. These characteristics assure safe surgical sterilization - in the area of the chamber in which the control is located.

The coolest section of any sterilizer is always the lowest area, and the hardest part of the load for the steam to penetrate is the dense center part of the most tightly wrapped package located on the bottom of the sterilizer. This then should be the location of your sterilization detector. If the sterilizer is air-clogged and not working properly, the difference in temperature between the top and the bottom of a uniform load can easily be 50 degrees; or the difference in temperature between the outside covering of a heavy pack and the center of that pack may be as much as 50 degrees for a prolonged period of time.

Routinely, the Diack Control should be placed in the center of the largest pack in the load. The attached thread of the control should be conducted out through the cover so that the control can be withdrawn after a known period of exposure without contaminating the contents or disturbing the wrapper. Place the pack on the bottom of the sterilizer near the center of the machine.

Inspect the control immediately before any of the load is taken away. If the control is not fused (melted), something definitely has gone wrong. The trouble can and must be traced - usually to one or more of the three sources of difficulty stated above. Of course, the entire load should be resterilized and checked by a fresh control. The Diack Control has been frequently checked and always proved efficient so it is not fair to assume that it is faulty if it fails to fuse. Look elsewhere for the cause of the poor performance.

The Boiling Method

Boiling water is the simplest method of surgical sterilization and used chiefly for sterilizing instruments (except those with lenses), metal utensils and enamelware. Sodium Carbonate (1%) may be used in the water to prevent rusting and corrosion, and it also is said to raise the boiling point of water (212°F.) about 5°F.

Physical Means of Sterilization

The most recent method for sterilization has been ultraviolet light. Ultraviolet lights are placed above the operating table in an attempt to sterilize the air and thus insure a completely sterile environment.

THE PREPARATION AND STERILIZATION OF SURGICAL SUPPLIES

The preparation of surgical supplies and their sterilization is carried out in the operating division. The two procedures may be done in a Central Supply Room, or in separate rooms; work room and sterilizing room. The preparation of gauze for sponges and dressings, their wrapping and storing following sterilization; also the proper assembling, wrapping for sterilization and storage of special equipment (intravenous sets, etc.) and storage of special equipment for emergency use is performed in the supply or "work room". Also, the wrapping of gowns, gloves, drapes and utensils is done in this room.

As much of the technician's work involves procedures carried out in the work room and sterilizing room, he must be familiar with (1) the preparation of materials for sterilization; (2) recommended periods of exposure, and (3) methods of loading the pressure steam sterilizer.

The efficiency of the newer thermostatic controlled sterilizers can be maintained at one hundred per cent efficiency, if the simple operating directions are followed (Chap.IV.). However, strict attention must be paid to the details of the proper preparation of materials and the loading of these materials in the chamber; otherwise the most highly efficient machine will lose much of its value. If the character of the load and its arrangement in the sterilizer is uniform, a known safe exposure period can be prescribed, but if the methods are not uniform and not in accord with correct principles then every changing load becomes another problem.

In the pressure steam sterilizer the movement of air out of packs and the penetration of steam which follows, always occurs in a downward direction, since air is more than twice heavier than steam. There is no sidewise movement of the air and steam in the chamber after pressure has been developed, (Chap.IV.). These facts greatly influence the methods of wrapping packages and arranging them in the sterilizer. The load must be arranged so every advantage can be taken of the downward flow of steam. Place all goods in the chamber so that <u>if</u> they contained water or were saturated with water, it could easily drain out. This means that flat packs of gowns, sheets and towels just the same as the enamelware jar, should rest on edge in the chamber, not flat side down. If there are many flat packs in the load, they should never be compressed together. That merely handicaps the sterilizer. Arrange every dense pack so that there is some steam space between it and adjacent packs.

PACKAGES MADE UP OF MANY LAYERS OF DENSE FABRIC SUCH AS TABLE COVERS, SHEETS, GOWNS, SHOULD ALWAYS BE PLACED IN STERILIZER ON EDGE TO PERMIT RAPID DOWNWARD PASSAGE OF AIR FROM THE PACKAGE AND THE CORRESPONDING ENTRANCE OF STEAM. THE ARROWS INDICATE HOW PENETRATION OCCURS OR IS RESISTED.

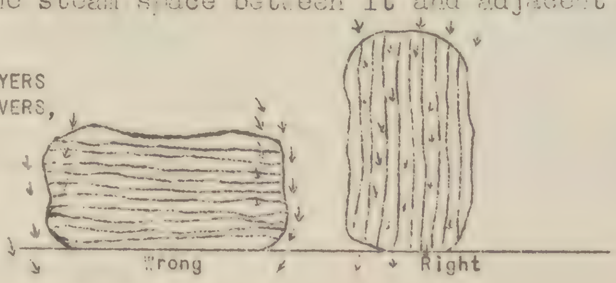
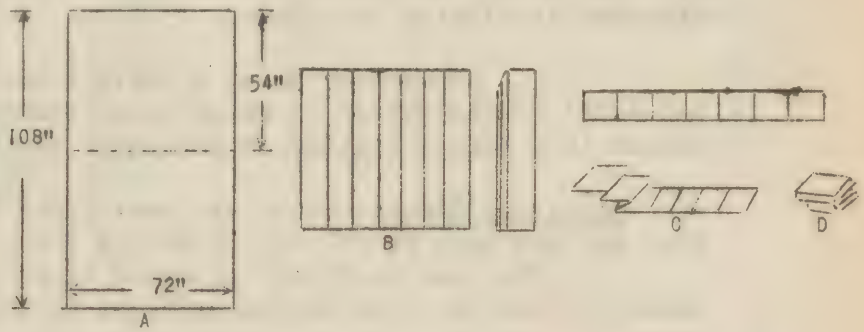


Table Covers, Gowns, Drape Sheets and Laparotomy Sheets, etc.

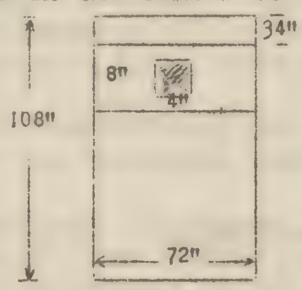
Table Covers (or sheets): used to cover over the tables in the operating room. It is usually of heavy muslin 108" x 72" and in preparation is folded twice on itself, to make four thicknesses (54" x 36").

Drape Sheets are muslin sheets about 108" x 72" and are used in draping the patient for the operation. To prepare it for sterilization, it is first folded upon itself crossways making two thicknesses 54" x 72", and is then fan-folded in two directions, as shown below:

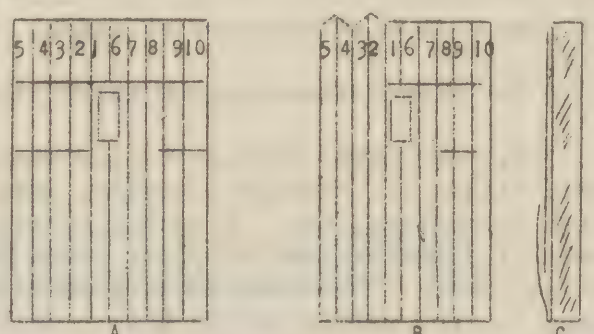


Laparotomy Sheets:

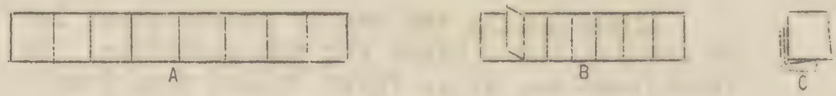
1. Large: muslin sheet 108" x 72". A strip of muslin 12" x 72" is sewn across the sheet 34" from one end. Then an opening 4" x 8" is made in the center of the muslin strip.



For sterilization the large laparotomy sheet is fan-folded in a manner described below:



Strip No. 2 is brought directly over Strip No. 1, No. 4 over No. 3, thus ending up with No. 5 on top. Strip No. 6 is then folded over No. 5, No. 8 over No. 7 and No. 10 over No. 9. This results in a long narrow strip with the opening on the bottom.



Strip No. 2 is folded over No. 1, No. 4 over No. 3, No. 6 over No. 5 and No. 8 over No. 7. The article is now ready for wrapping or placing in a drum.

2. Laparotomy sheet - small - two thicknesses of muslin 36" x 36" in the center of which is an opening 2" x 2". These are folded in a manner similar to the large lap sheet.

<u>Operating Gowns</u>: these are usually of a standard type in the Army and are worn by all the operating team.

The gown is first inspected to see if it contains any holes, if all the ties are present and if the gauntlets are in place.

Folding of gown for sterilization: The technician's hands are placed in the arm holes and the two shoulder seams are brought together. Then the portion of the gown draped over the left hand is inverted over the right hand, thus making the gown turn in-side-out. The gown is then folded once on itself length-wise. Starting at the neckband the gown is fan-folded, making a rectangular package. All ties are well tucked in.

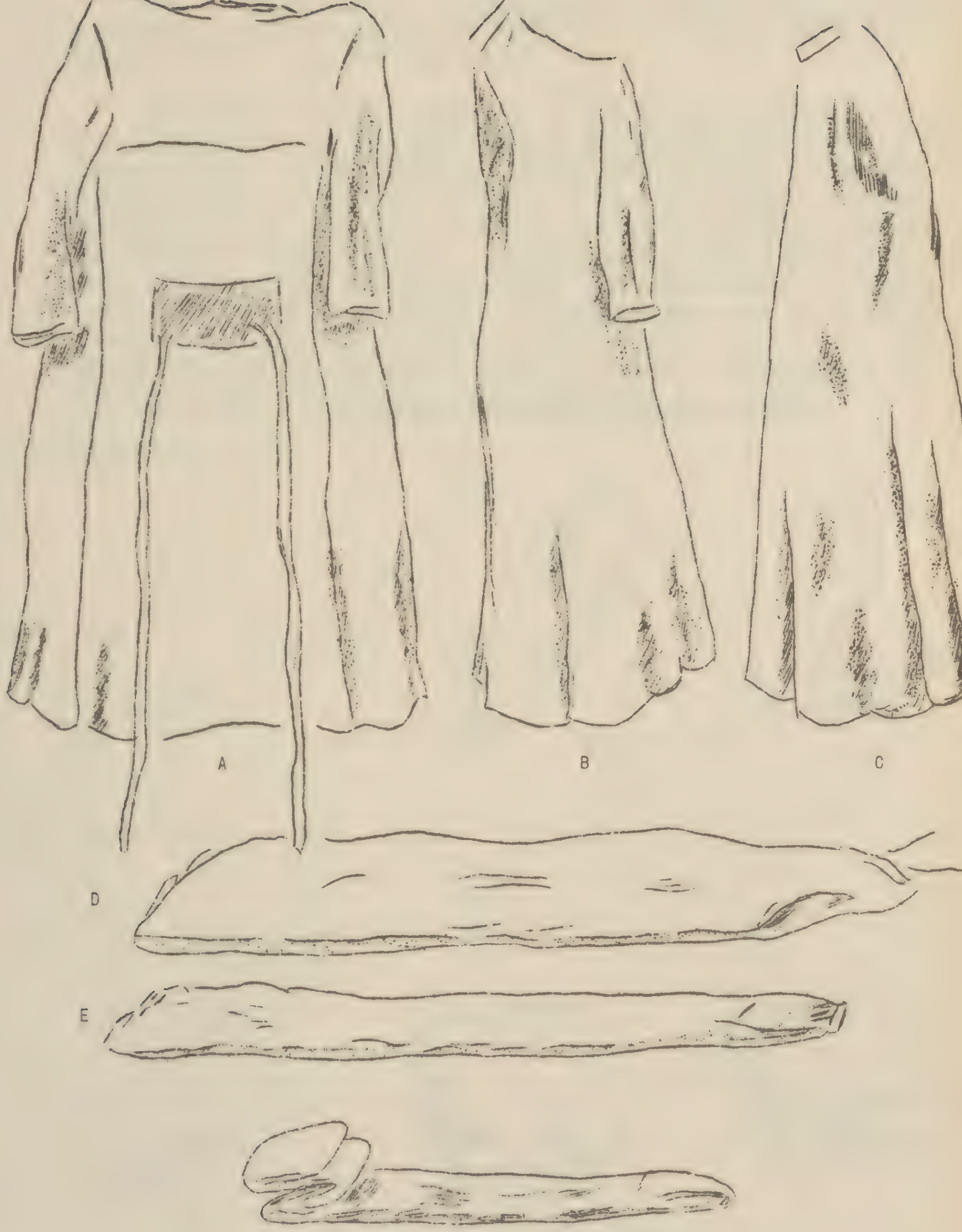
<u>Towels</u>: May be of either regular toweling but may be of muslin 18" x 9". Folded crosswise and crosswise again for sterilization.

<u>Surgical Dressings</u>: Surgical dressings are made from gauze, cotton flannel, linen, etc. They may be purchased already made up or be made by the technician in the supply room.

1. Flat gauze dressings or sponges commonly called flats are of various sizes, 2" x 2", 4" x 4" and 4" x 8" and are usually of from 6 to 8 thicknesses of gauze. All raw edges are turned in.

2. Larger flats may be rolled into a ball and termed a "fluff".

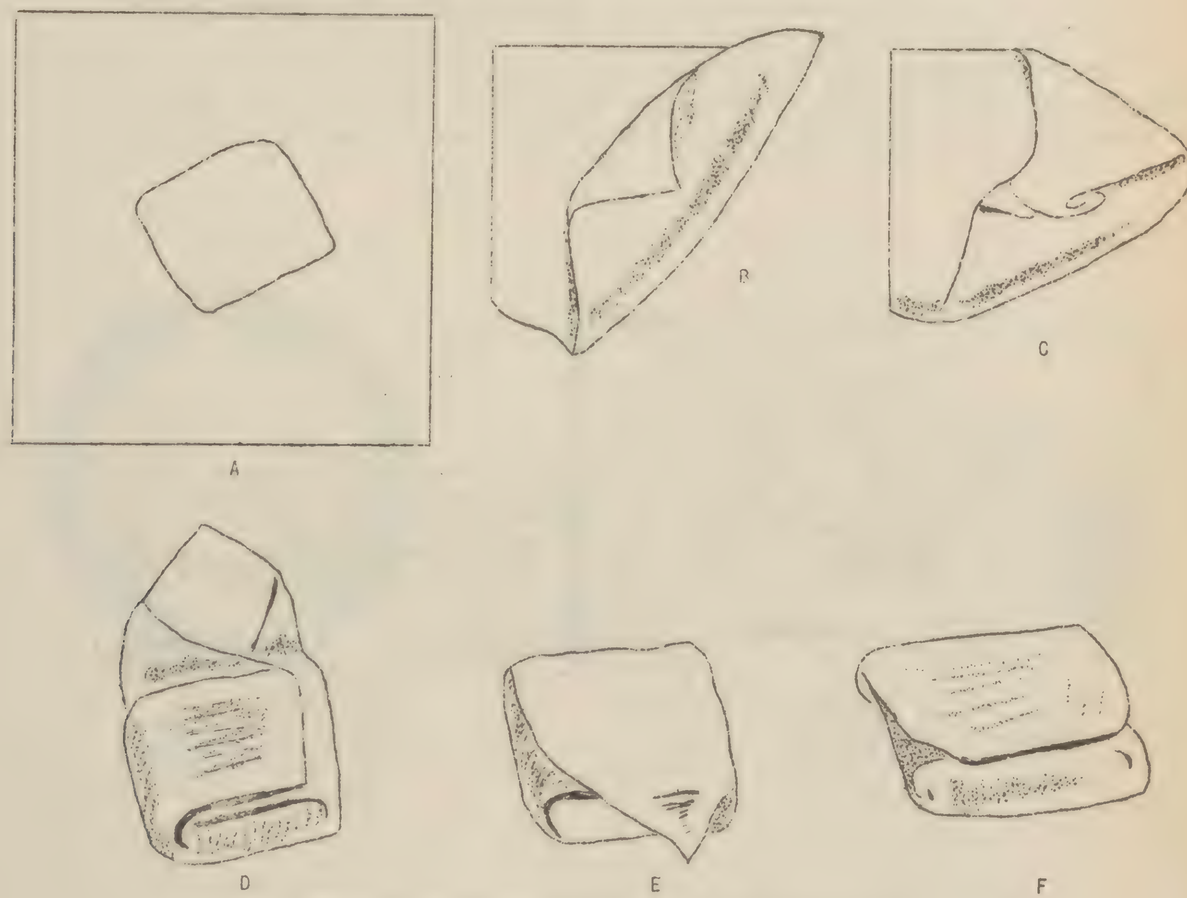
3. Abdominal "tapes" (taped sponges), packs or sponges are used within the abdominal cavity, particularly for "packing-off" with intestines, etc., from the operative site. They are usually made of 8 thicknesses of plain gauze with all the raw edges turned in and sewed. To avoid leaving them in the abdomen, a tape is sewn to one corner and to this a metal ring is secured. The usual sizes are 6" x 18", 4" x 18" and 12" x 12".


A
B
C
D
E

4. Abdominal pads are made of absorbent cotton wrapped in an outer covering of gauze. The common sites of pads are 8" x 10" and 12" x 16". They are used in wound dressings, particularly of the abdomen, for coverage, absorbing fluids and protection from pressure.

Table covers, gowns, drapes, sheets, towels, pillow cases and surgical dressings may be wrapped in muslin or placed in a drum container for sterilization.

If muslin is used, remember to use two thicknesses. The double thickness cover offers no considerable resistance to the escape of air or the intake of steam, and is amply protective. More than two thicknesses for covers is unnecessary. Canvas should never be used as a cover or for lining a "drum", as it is very tightly woven and will seriously retard sterilization. The method of wrapping should eliminate any opportunity for loose ends to work out in ordinary handling, so that any part of the contents is exposed. The pack also should be wrapped in such a manner that it can be easily opened without contaminating any of its contents. <u>Do not wrap dense materials too tightly</u>!

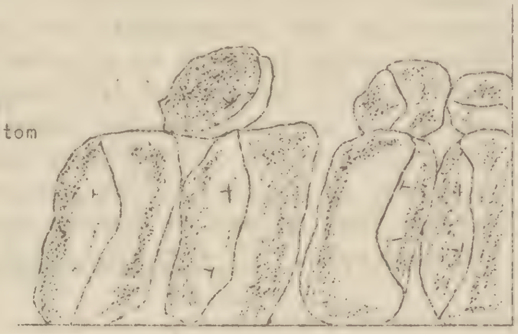


WRAPPING OF PACKAGE WITH DOUBLE THICKNESS OF MUSLIN

As stated above, gowns, sheets, covers, etc., should be fan-folded into rectangular packs rather than rolled. These articles are made from fairly dense, tightly woven fabrics through which air and steam can be dissipated rather slowly. If rolled into a tight mass there is danger of trapping air in the inner folds. Folded flat, it is always easy to stack the packs on edge in order for the air to be evacuated. If there are a number of flat packages of dense materials to be sterilized in one load, stack them in the sterilizer on the tray in the bottom, on edge. Put the lighter, more porous packages (gauze, etc.) in the top of the chamber.

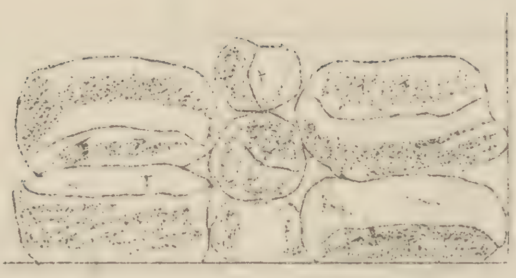
A. Heavy dense packages of flat materials on edge in the bottom of the sterilizer.

(UNDERWOOD)



B. Wrong method of loading sterilizer.

(UNDERWOOD)



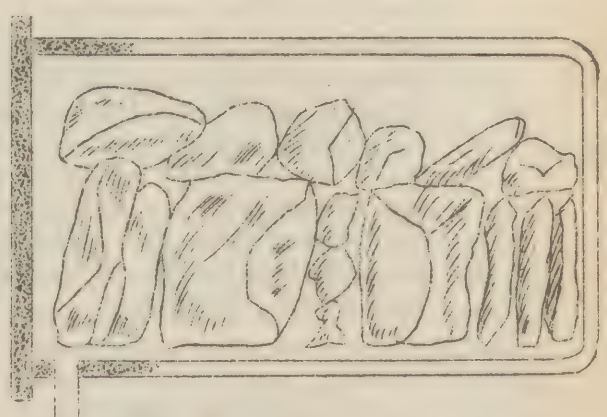
Gauze sponges, or pads of gauze in any form are easily sterilized. Gauze is so loosely woven that in large masses and considerably compressed, it offers very little resistance to the escape of air and the entrance of steam. In loading sterilizers, it is desirable to use packages of this kind with which to separate unusually heavy masses of gowns, sheets and the like.

Do not permit the use of abnormally heavy or dense packs. The practice of using large, dense bundles, involves too many hazards. The largest pack should not exceed 12" x 12" x 18" or 20" in size for routine work.

Avoid crowding materials in the sterilizer. In the ordinary load of loose packages, those not carried in drums, there will usually be found a mixed variety of heavy dense packs of gowns, sheets, drapes, etc., and smaller packages of light and very porous materials. A system must be followed each time and when the chamber has been filled in this manner, do not crowd in any more packs.

Place the large, flat packs on edge at the bottom of the chamber. Thin flat packs can be crowded together quite compactly. The larger packs can be separated from each other by loosely woven packs of gauze, etc. Leave plenty of open spaces through the load so that steam can circulate to all parts freely. No pack, not even a light one, should be in actual tight contact with the top wall of the chamber. A flat pack should not be in contact with the side walls of the sterilizer because it will be pocketed against steam contact except as the steam is admitted from other surfaces.

A. Open end of sterilizing chamber. The heavy packs, placed on edge are separated by light packs of loose material. (UNDERWOOD)



B. Longitudinal section of the loaded chamber. (UNDERWOOD)

Drums or Containers - the drum may be utilized to sterilize most of the drapes, sheets, towels, etc. needed for an operation. A sample list is given below:

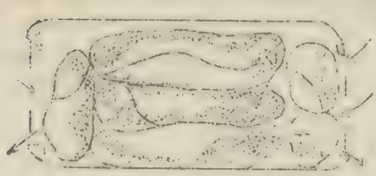
1. The "ABD" Drum
    a. One (1) drum lining.
    b. One (1) large laparotomy sheet.
    c. One (1) spinal sheet (small lap sheet).
    d. Two (2) drape sheets.
    e. Twenty (20) hand towels.
    f. Two (2) skin towels.
    g. One (1) bath towel.
    h. Two (2) large abdominal sponges.
    i. Six (6) small abdominal sponges.
    j. Twenty-four (24) 4" x 4" flat gauze sponges.
    k. Four (4) pillow cases (or covers for small instrument table).
    l. One (1) Diack control placed in center of packed drum.
    m. One (1) table cover.

The lining of the drum should be of double thickness muslin in the shape of a bag, closed at the bottom and with sides about ten inches deeper than the drum. Folding over the extended top eliminates danger of contamination in handling and provides a convenient method of safeguarding the handling of sterile materials from the drum (edges brought down over drum edges).

The articles are placed in the drum in the order listed, in such a manner as to take advantage of the downward flow of the steam. Tight packing, stuffing of the drum with more material than it is intended to hold, handicaps sterilization seriously and may double the exposure period. Flat materials should be laid in the drum flat side down - never rolled. Dense fabrics should not be compressed against the sides so as to shut off the port holes. Place the rectangular folded sheets, cover, towels, etc., in the center of the drum and fill in the side with gauze sponges or other light porous substances.

Drums are placed on edge in the sterilizer, the open port holes in the side walls facilitating the discharge of air from the bottom and the intake of steam at top. When the drum is to be removed from the sterilizer, the portholes are closed to prevent the intake of dust-laden air. None are absolutely dust proof, however.

DRUMS



A. Wrong method of placing drum in chamber. Air is pocketed in drum if it is placed flat side down. (UNDERWOOD)

B. Right method. Steam will circulate freely through a drum lying on edge. (UNDERWOOD)

Paper wrappers, heavy paper bags or Kraft wrapping paper, may be used to enclose certain supplies, such as gauze, sponges and cotton pledgets used on the ward. However, general surgical supplies should not be wrapped in paper because it is so easily ruptured.

Enamelware - Jars with loose fitting covers - these jars are used mainly for containing gauze strips or cotton pledgets or other light surgical supplies. Always place these jars on edge for in the upright position all air contained will be pocketed and effective sterilization will not result. The covers of all the jars should be loose fitting and if screw covers are used, they must be loosened up in the sterilizer. Some type of cover must be used to prevent contamination when the load is removed.

Tie the covers on loosely with a muslin cover or piece of gauze and place the jars always on their sides. In this position the air will gravitate out and the steam will enter freely, as indicated by the figure below.

Rubber Table Covers or Drapes - These are probably the most difficult materials to sterilize found in the surgery. If at all possible, refrain from the use of rubber drapes. The problem here is to prevent air from being pocketed in the center folds and in getting steam to these points.

They should be folded once on the narrow dimension with the surfaces inside the fold, well separated by a muslin covered cotton pad about half an inch thick. Then insert the folded sheet in a double thickness muslin bag long enough to contain the full length of the sheet, with ample margin at the open end for a folded closure. Roll the package loosely and place it in the sterilizer on top of all other packages to avoid any compression.

Recommended Period of Exposure - (For bulk supplies, such as gowns, sheets, towels, various dressings and drums that are loosely packed).

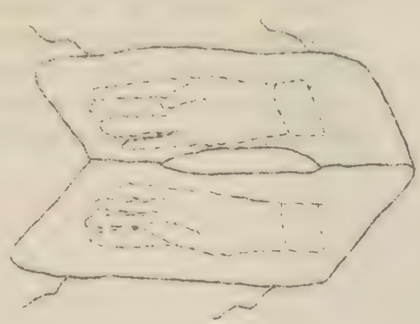
If the packs are kept within defined limits as to size, if the wrappers are made from muslin and only two thicknesses are used, if the load is placed in the sterilizer properly, there is no occasion to continue the exposure period beyond thirty (30) minutes, - starting the timing at 240°F., with a maximum temperature of 254°F. If it takes longer than 30 minutes to sterilize a pack, for routine work, the pack is too large. Fully packed drums should be exposed for 45 minutes.

Vaseline, bulk talcum powder and bonewax - these should be sent to the laboratory and sterilized in the hot air oven for one hour at 300° - 350°F.

Rubber Gloves - cleaning and sterilization:

1. Inspect for holes, tears, etc.
2. Wash thoroughly with warm water and tincture of green soap.
3. Rinse thoroughly in warm water.
4. Immerse in boiling water for 3 minutes.
5. Dry thoroughly in warm, dry air on a glove rack. Be sure that every part of the inside of the glove is dry.
6. Sprinkle thoroughly inside and out with talcum.
7. Insert in each glove, at the palm, a small wad of gauze impregnated with talcum for the surgeon's use. This pad extends as far as, but not into, the fingers.
8. Turn back the wrist of the glove about 2" over a thin pad of gauze.
9. A pair of gloves is then placed in a roomy double muslin pack which is made like a billfold, with a pocket for one glove on either side of the median line. The glove is placed longitudinal with little finger closest to opening of pocket. The end of each opening of the pocket should be sewed up for a space of 1 1/2" to protect against contaminating contacts at the ends in handling.
10. Tie strings should be provided at each end of the pack.

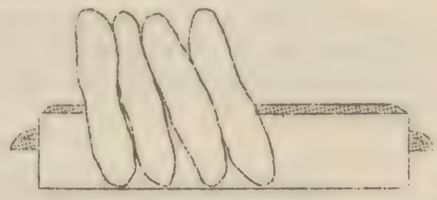
Rubber gloves in double thickness muslin wrapper.



An instrument sterilizer tray serves as an excellent container for packs of rubber gloves which should always be placed on edge, as indicated in the previous diagram. Gloves should always be sterilized by themselves to avoid tightly massed packing.

Fifteen (15) to twenty (20) minutes exposure to 240°- 250° F., with the pressure maintained at 15-17 pounds, is recommended. Longer periods or higher temperatures cannot be tolerated by the gloves.

Packs of rubber gloves set in a large instrument tray.



Sterilization of Utensils:

Utensils are made usually of enameled iron or some non-corrosive material, so that there is no danger of rusting.

Utensils may be boiled for 20-30 minutes, but this method deposits scale, leaving the surface appearing dirty. A better method is pressure steam sterilization. Each utensil should be wrapped individually or nested with muslin between each article in double thickness. The muslin covers permit safe storage and transportation.

Each utensil (or rest of utensils) should be turned on its side so that any water contained in it will all drain out. Avoid placing utensils above the supplies. Preferably, sterilize utensils by themselves for an exposure period of fifteen (15) minutes to 20 minutes. If it is more convenient, they can be sterilized with the dressings, drapes, etc., for thirty (30) minutes. Single utensils in double muslin covers only require 10 minutes exposure.

Sterilization of Rubber Tubing:

Adhering to the general rule for sterilization, if the tubing is so arranged in the sterilizer that any water contained in it would all flow out, then air will similarly flow out and steam will immediately take its place. Avoid any compression of the tubing.

The tubing may be wrapped loosely around a towel rolled into a cylinder and fastened (without pinching) with safety pins.

The sterilizing temperature should range between 240 and 250°F. and the period of exposure should not exceed 15 minutes. 15 to 17 pounds of pressure should be automatically maintained.

Sterilization of Suture and Ligature Materials:

Suture - a surgical stitch or seam. Used loosely, it refers to the materials used in suturing. It is placed with the aid of a surgical needle.

Ligature - a thread or wire for tying a vessel or strangulating a part. A needle is not used in placing a ligature.

Suture-ligature - a hemostatic suture.

There are two principal kinds of sutures and ligatures, absorbable and non-absorbable. An absorbable suture or ligature is one which becomes dissolved in the body fluids and disappears in a certain length of time. A non-absorbable suture will not dissolve.

Absorbable Sutures and Ligatures:

1. Cat gut
    a. Plain
    b. Chromic

Cat gut sutures are made from the submucous coat of the intestine of sheep. They are usually used in the deeper structures, such as subcutaneous tissue, fascia, muscles, peritoneum and within a cavity. Plain cat gut is supposed to last from eight to ten days in the tissue. A chromic gut is prepared by treating plain cat gut with a chromic acid preparation. This tenders it less vulnerable to the body fluids and chromic gut will last from ten to twenty days in the tissue.

Gut sutures come in various sizes, ranging from No. 000 to 3.

An atraumatic intestinal suture is a gut suture to which a needle is attached (by the manufacturer) in such a manner that the perforation made by the needle is not enlarged by the entrance of the suture itself (ordinary suture is doubled at eye of needle).

2. Kangaroo tendon, which is made from the tail of a kangaroo is absorbable, but is stronger and heavier than gut and lasts about thirty days in the tissue. It comes in fine, medium and coarse. Kangaroo tendon is used in the repair of large, severed tendons, recurrent hernias and in bone operations.

Gut sutures are usually issued in glass tubes which, if marked boilable, may be boiled or autoclaved. If marked unboilable, they should be first washed well with green soap, and soaked in a 5% solution of Phenol for 12 hours. If phenol or cresol is used, the tubes should be removed from this solution and placed in 70% alcohol just prior to the operation.

Non-absorbable Sutures:

1. Silk, cotton and linen comes in sizes from No. 000 to No. 8. Silk and cotton are used extensively in the skin, while some surgeons also utilize it in the deeper tissues. These materials are wound loosely on paraffined wooden spools and exposed for a period of thirty (30) minutes with a maximum temperature of 250-254°F. If silk sutures are artifically waxed, the wax definitely should be sterilized in the hot air oven for one hour at 320°F.

Silk, etc., also may be boiled twenty (20) minutes. However, this process weakens the material. Only small quantities of silk, linen, etc., should be sterilized at one time, as they will not stand frequent sterilization.

2. Silkworm Gut - is made from the small silk gland of the silkworm and is non-absorbable. It comes in fine, medium and coarse. It is used chiefly in so-called "tension" sutures, which are placed to prevent disruption of viscera, to relieve pull along the incision line, and the like. Silkworm gut should be submerged into distilled water in a suitable vessel and autoclaved for 30 minutes at a maximum temperature of 250-254°F.

Silkworm gut may also be boiled for 30 minutes and then stored in a solution of tincture of iodine and glycerine, (70 parts of tincture of iodine and 30 parts of glycerine).

3. Wire - is usually made of an alloy or silver. It can be measured into the desired lengths needed for each suture, placed in a small paper envelope and autoclaved for 15 minutes at 250-254°F. This is the best method. Wire may also be sterilized by boiling for 20 minutes or immersing in saponated cresol for 30 minutes, and then rinsed in 70% alcohol before use.

4. Horsehair - is heavily contaminated with spores and the usual autoclaving procedure may be inadequate. The sutures should be secured from the manufacturer only in the sterile form. A common method employed by the manufacturers is to cleanse the hair thoroughly and then sterilize with dry heat sterilization (hot air oven).

5. Skin Clips (Michel clips) - these are small sharp-pronged metallic clamps of easily bended metal used to hold the skin edges of the incision together, in place of silk or cotton.

The number needed for an operation are placed on a "U" shaped piece of wire and autoclaved for ten minutes at 250-254°F., or boiled for twenty (20) minutes.

Nailbrushes, Orangewood Sticks and Files:

First, the brushes should be thoroughly washed. Place brushes in a perforated instrument tray, bottom side up, with nothing on top but a muslin cover over the entire tray. Sterilize 10 minutes (no more) at a maximum temperature of 240-250°F. Brushes can also be boiled for 20 minutes (without compression) and kept sterile in a mild solution of saponated cresol.

Drains:

Drains may be either tubular or capillary, or a combination of both. Thin latex rubber drains, the so-called Penrose drain, and soft red rubber drains, are the most commonly used of the tubular type. Tubular glass drains are still used by some surgeons.

The Penrose Drain (latex) and soft rubber drains, may be boiled for twenty minutes or autoclaved. To prepare them for the sterilizer, they may be rolled loosely (lengthwise) in gauze impregnated with talcum and placed in an open enamelware pan. No two surfaces of the rubber should touch, or it will vulcanize. Expose the drains to a temperature of 240 to 250°F. for fifteen minutes (15-17 pounds pressure).

Gauze drains constitute the most popular and widely used of the capillary type.

Plain gauze packing (1" to 3" in width) may be rolled to the desired length, wrapped in a double thickness muslin cover and autoclaved for 30 minutes at 240 to 250°F. Gauze (1/2" to 1") may also be loosely fan-folded into a jar or test tube and sterilized in the pressure steam sterilizer as above.

Iodoform gauze: this can be obtained in sterile form from the manufacturer, unless the demand be heavy. Iodoform powder will not stand sterilization, so it is necessary to prepare this drainage material under strict aseptic technique. The technician scrubs, has on cap and mask, sterile gown and gloves, and uses sterile table drapes. A paste is made from the iodoform powder and sterile glycerine (hot air oven for one hour at 320°F.), and 95% alcohol is added until the paste is dissolved and the solution is uniformly yellow. The gauze is wet in sterile water and the excess wrung dry. Dip the gauze in iodoform solution until saturated, and then squeeze out the excess but do not wring dry. Place in sterile bottles and seal tightly (cork, with adhesive or paraffin).

Cigarette drains are a combination of the tubular and capillary type. They are made by surrounding a strip of gauze with latex rubber, gutta percha, etc., or by placing a strip of gauze in the tubular portion of a hollow Penrose Drain. They are sterilized exactly like the open latex or gutta percha tubular drains (Penrose).

Rubber dam is rolled loosely with gauze separating the surfaces and sterilized in the pressure steam sterilizer for 15 minutes at 240 to 250°F.

CHAPTER VI.

THE CARE AND STERILIZATION OF SURGICAL INSTRUMENTS

There are many different kinds of surgical instruments. It is not necessary for you to memorize long lists of instruments. The array of instruments displayed in surgical catalogues is bewildering and no description is furnished as to their proper use.

Instruments are best studied by means of a simple classification. There are five basic types of surgical tools:

1. Cutting Instruments.
2. Hemostatic Instruments.
3. Holding or Retracting Instruments.
4. Suturing Instruments.

Each new instrument encountered by the technician should be put in its proper place in the above grouping. There is a common tendency among surgeons to call instruments by the last name of the surgeon who devised or modified the instrument. This is a bad practice and should be forgotten. The Pean, Kelly, Locher, Ochsner, Mixter, Crile, Mayo, Halstead, and Carmaldt forceps need only be known to the technician as varieties of hemostatic instruments. Similarly, the technician need not know a Hagedorn from an Emmet, Skene, or Keith needle, but it is important to know the difference between a cutting and a round-pointed needle.

Cutting Instruments:

1. Scalpel (operating knife) - an excellent knife is the Bard-Parker scalpel which consists of a rustless metal handle with detachable blades. Blades are supplied in many shapes suitable for various operations.
2. Scissors - these may be curved or straight, long or short, heavy or light, with a sharp or blunt nose, with plain or dissecting blades. For general utility, medium-sized scissors, straight or curved, with dissecting blades, meet most requirements.
3. Chisels - used in operations on bone.
4. Bone cutting forceps.
5. Saws and Drills.
6. Curettes - sharp and dull. This is a kind of scraper or spoon for removing growths or other matter from the walls of cavities.

Hemostatic Instruments (Angiotryptic, or crushing clamps).

A hemostatic instrument is one used to arrest the flow of blood. These instruments are placed on either the cut ends of blood vessels or are placed on the vessel before it is severed between the clamps. They are all crushing instruments. A ligature or suture ligature of cat gut or silk is placed below the clamp which is then removed.

It is not absolutely essential that one be familiar with the various types of joints, jaws, curves, and locks which constitute the distinguishing characteristics of the hemostatic forceps. They are all hinged, crushing instruments with a self-locking device on the handles to prevent the clamp from slipping off the bleeding vessel.

Holding or Retracting Instruments:

1. Retractors - these are instruments for holding back the edges of the wound. These may have smooth ends (blunt retractors) or claws (sharp retractors), be flexible or non-flexible, and self-retaining or non-self-retaining.

2. Holding Forceps:
   - a. Tissue Forceps - these instruments are used to hold the soft tissues while they are being sutured, dissected or excised (cut away). The forceps may be either plain or with teeth (mouse-toothed). Instruments with teeth are used for general work, because of the greater security of their grasp, while only plain forceps are employed in handling blood vessels, nerves and similar tissues.
   - b. Dressing Forceps - plain forceps, so-called because they are used to apply sterile dressings on a wound.
   - c. Intestinal holding forceps - spring type; hinged type.
   - d. Bone holding forceps - hinged instruments used to hold bone while operator is working on it.

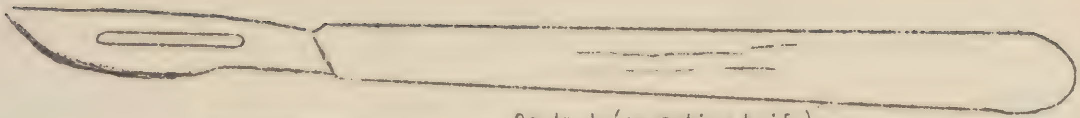
3. Retracting Clamps - hinged clamps used for the retraction of tissues. A clamp with a single tooth is referred to as a tenaculum; one with many teeth, as a volsellum.

Suturing Instruments:

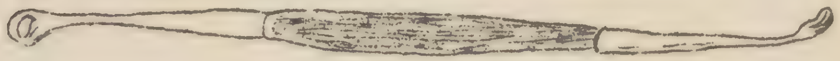
1. Needle Holder - hinged instruments not unlike a large hemostatic forcep to hold a curved needle while suturing.

2. Surgical Needles - these are supplied in many styles, differing in regard to shape, length, type of eye, and type of tip. Needles may be cutting or round, straight or curved.
   - a. Round needles - a round needle means that the tip is round or non-cutting, and not that the needle is round or curved in shape. This type of needle is used for transfixing tissues, suturing within a wound and suturing near vessels.

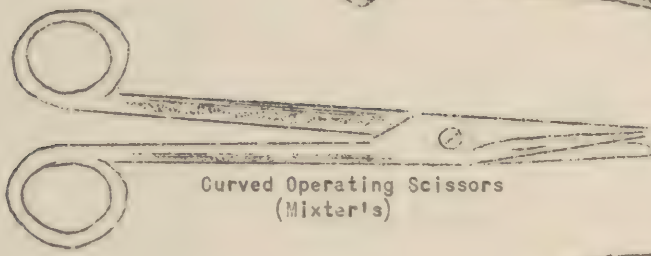
CUTTING INSTRUMENTS



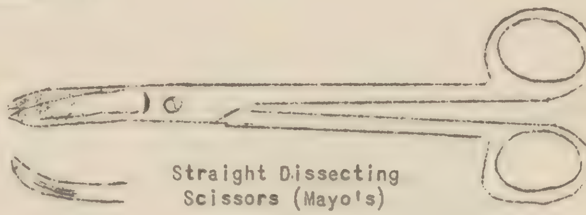
Scalpel (operating knife)
with removable blade



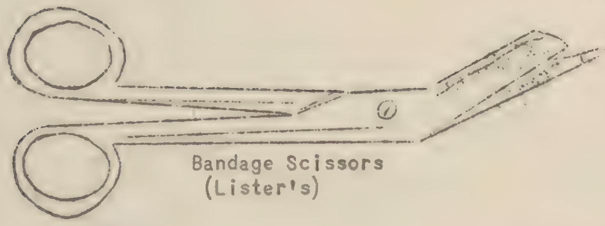
Curette



Curved Operating Scissors
(Mixter's)

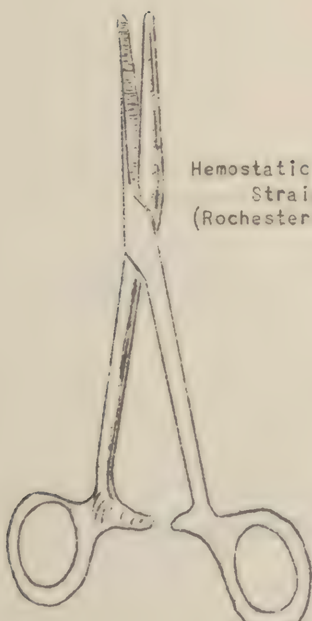


Straight Dissecting
Scissors (Mayo's)

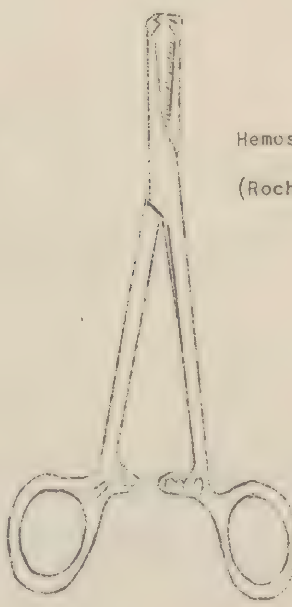


Bandage Scissors
(Lister's)

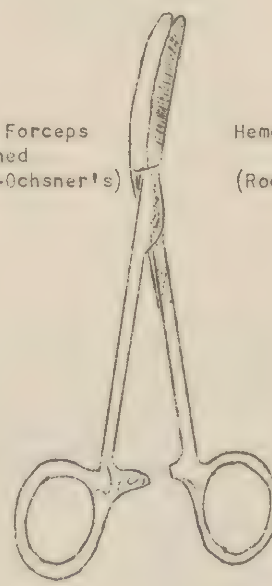
HEMOSTATIC INSTRUMENTS



Hemostatic Forceps
Straight
(Rochester-Pean's)



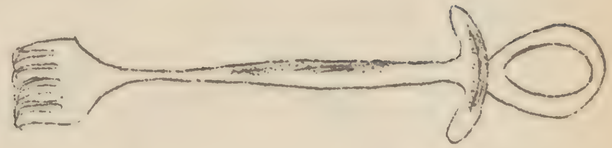
Hemostatic Forceps
Toothed
(Rochester-Ochsner's)



Hemostatic Forceps
Curved
(Rochester-Pean's)

HOLDING AND RETRACTING INSTRUMENTS

Retractor
Sharp
(Schultz's)

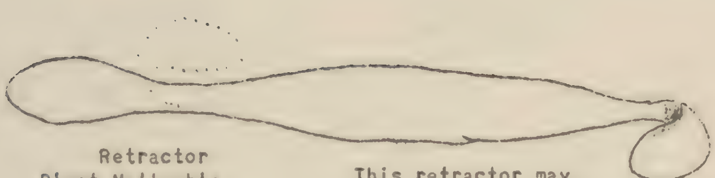


Holding Forceps
Dressing Forceps

Holding Forceps
Intestinal and Marginal
Tissue Forceps (Allis')

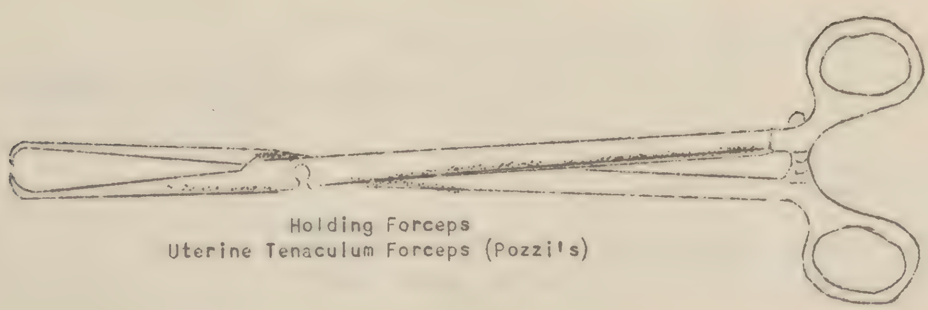
Holding Forceps
Tissue Forceps
(Kelly's)

Holding Forceps
Towel Forceps



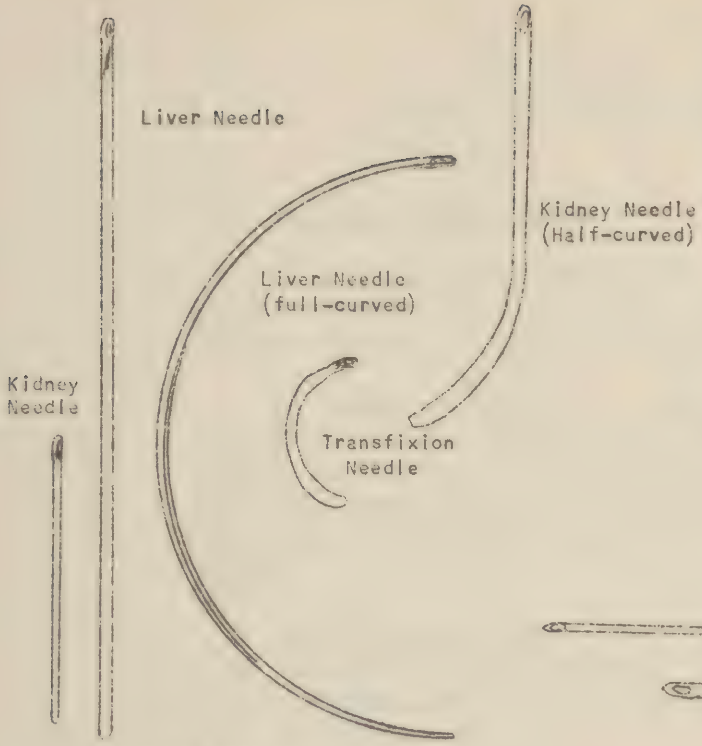
Retractor
Blunt Malleable
(Parker's)

This retractor may
be bent as the surgeon
desires.

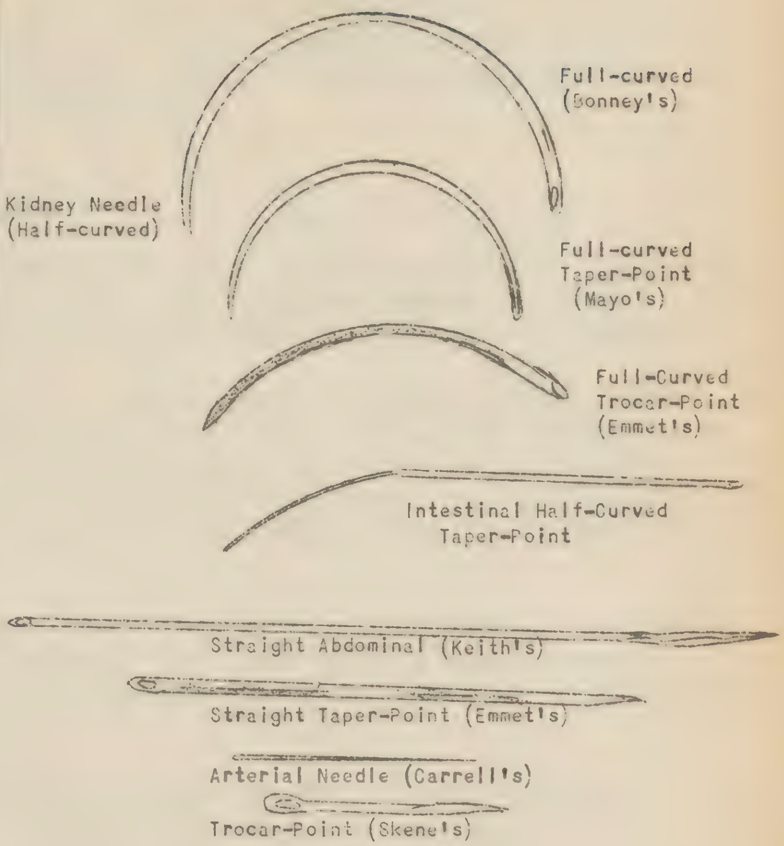


Holding Forceps
Uterine Tenaculum Forceps (Pozzi's)

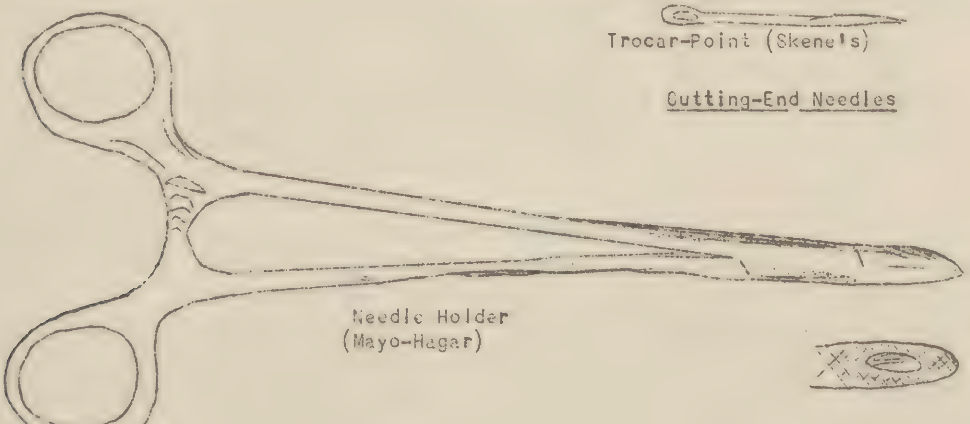
SUTURING INSTRUMENTS

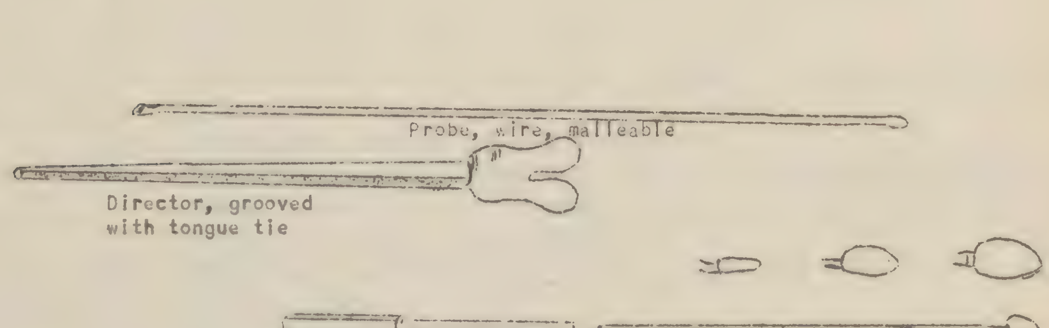


Round-End Needles



Cutting-End Needles





Probing Instruments

b. Cutting needles - sharp pointed needles used in suturing tough tissue such as the skin.
c. Curved - the full-curved variety is preferable, on account of the greater ease in suturing within small deep spaces.
d. Straight.

Probing Instruments:

1. Probes - the probe is a fine straight malleable instrument having a bulb-like tip. These probes may be hooked or bent at will to aid in following a crooked pathway of a sinus or fistula.

2. Grooved Director - special type of probe, having a blunt end and a canal along its long axis. This is used in probing an abscess so that pus may flow out along the canal; to guide the malleable probe and also to control the pathway and depth of an incision, during certain operations performed without direct vision.

The Dissecting Set - the instruments required for an operation vary according to the nature of the operation and the surgeon. The following set serves as a foundation from which to build for most of the operations.

1. Two-inch and one-inch metal ribbon, malleable, blunt retractor or spatula.
2. Two Kelly blunt retractors, different sizes.
3. Murphy rake sharp retractors (4 and 6 prongs).
4. Sponge stick #6, of each.
5. Grooved director.
6. Ordinary probe.
7. Right and left aneurysm needles.
8. Bard-Parker knife handle No. 4 and No. 20 blade.
   Bard-Parker knife handle No. 3 with No. 11 blade.
9. Straight dissecting (Mayo) scissors #1, of each.
10. Curved dissecting (Mayo) scissors #1, of each.
11. Small straight hemostatic forceps (Hemostats) #12, of each.
12. Ochsner Hemostatic Forceps - large straight, #6, of each.
13. Curved Kelly Hemostatic Forceps #12, of each.
14. Towel clips #12, of each.
15. Medium-sized needle holder #2, of each.
16. Allis Forceps - (intestinal holding forceps) #8, of each.
17. Five-inch tissue forceps, 1 x 2 teeth.
18. Five-inch smooth tissue forceps.
19. Needle kit containing all types of needles (straight, round intestinal, straight cutting, curved round intestinal, curved curring, Mayo needles).
20. Plain and chromic cat-gut (0 to #2) silk or Michel clips for the skin.
21. Medicine glasses #3, of each.
22. Assorted glass syringes and needles.
23. Laparotomy rings, #12, of each.
   (Special instruments would be added to the dissecting set depending upon the type of operation).

Care of Surgical Instruments:

When not in use, instruments should be kept in a dry, fairly air-tight cabinet. The cabinet should be in a dry room which is free from chemicals.

After the Operation: Immediately after an operation the forceps, retractors and similar metallic instruments are:

1. Washed well with running cold water to remove any blood clots.
2. Scoured with a powder like Bon Ami.
3. Sterilized:
   a. Autoclaving.
   b. Boiling.
   c. Chemically.
4. Dried carefully, paying particular attention to hinges and locked surfaces. Rusting will occur if the instrument is exposed to the air when moist.
5. (This step is optional and not advised by us) Covered with a thin film of oil. All traces of oil must be removed from the instrument before it is sterilized.
6. Stored in dry storage cabinet. Surgical needles are cleaned, scrubbed with Bon Ami, cleansed with benzene and ether, and sharpened.
7. After use in septic operation: Soiled instruments from a septic case may be soaked in 5% saponated cresol solution for one hour before being washed. A better procedure, especially if the case be one involving the spore-forming bacteria of Tetanus or Gas Gangrene, is to bring the soiled instruments directly to the autoclave and wash and sterilize them there. They are placed in a porcelain or monel metal basin, jointed instruments open, and covered with the hottest water available and add 15 cc. (table-spoonful) of tri-sodium-phosphate solution or Calgonite or Soilax. Place tray in autoclave by itself and expose it for 15 to 20 minutes at a maximum temperature of 250-254°F. At the close of the period of exposure, open up the exhaust and let the pressure escape as rapidly as possible. Wait until chamber gauge has shown zero pressure for a few minutes before opening door. Remove from sterilizer, pour off water and while instruments are still wet, wipe them off. No further cleansing is necessary. (Underwood).

Before the Operation

1. All oil should be removed from the instrument.
2. Sterilization of the instruments.

Sterilization of Instruments

At the present time four methods of sterilizing instruments are known. Each method has its followers who will loudly swear that it is the best and only proper method to sterilize instruments. We present all four, but in booming tones state that we believe autoclaving (pressure steam sterilization) to be the best procedure.

1. The Boiling Method: Instruments should be boiled for at least twenty minutes. For emergency sterilization, but only with the desire of the surgeon, the period of boiling may be reduced to ten minutes. The period should never be reduced beyond this point.

Many authorities advocate the use of 1/2 per cent soda (rather than plain water) in an effort to reduce the acidity of the water and prevent rusting and corrosion. Soda leaves a deposit on the instruments which should be wiped off or rinsed off in sterile water before use - paving the way for a possible break in technique and contamination of the instruments.

The natural impurities (minerals) in the water deposit in the sterilizer and on the instruments. This means a thorough scouring every time the instruments are washed and even so, the deposits are never completely removed from joints and crevices. A film remains, difficult to detect which is injurious to sharp edges and points.

2. Oil Sterilization of Instruments: Oil Sterilization should be considered to be a form of dry heat. At the temperature commonly employed (300 to 320°F.) the exposure period should continue for a full hour. It has been shown that spores are killed in fifteen minutes at 338 to 347°F, but this temperature breaks down even the best grades of oil. We do not recommend the oil sterilization of instruments.

3. Chemical Sterilization of Instruments: Delicate instruments and sharp or cutting instruments may be sterilized in chemicals with caution. However, for general surgical purposes, other means of sterilization are preferable. Seventy per cent alcohol, 1:20 phenol, fifty per cent saponated cresol soap added), a Bard-Parker solution (a commercial product), are the chemicals commonly employed in sterilization. Bichloride of Mercury and other corrosive chemicals should be avoided.

The instruments should be completely submerged in the chemical for 30 minutes. It is usually a good plan to keep the scalpel blades, etc., in the solution at all times when not in use.

4. Pressure Steam Sterilization of Instruments: Pressure steam sterilization is absolute in a brief period of exposure. There is no scale formation on the instruments as in the boiling method. Delicate instruments can be sterilized with less damage to sharp edges and points. With instruments there is no penetration of the steam. The steam sterilizes by surface contact.

A muslin cover or towel should be placed in the bottom of the instrument tray which supports the first layer of instruments. These are covered with muslin supporting the next layer, and so on until the tray is filled, with a final muslin cover over all. The muslin absorbs the drops of moisture which form on the instruments after the steam is turned off in the sterilizer. Needles can be sewn into a piece of muslin and wrapped.

The recommended period of exposure in the autoclave is ten minutes with a maximum temperature of from 250 to 254°F. For emergency sterilization the period can be shortened to five minutes. Wrapped instruments are exposed 15 to 20 minutes.

Sharp or Cutting Instruments

Dissecting scissors, scalpels and delicate eye, ear, nose and throat instruments fall into this category.

This type of instrument can be sterilized by chemicals or by pressure steam sterilization.

Bard-Parker solution or a 50% saponated solution of cresol may be used. The instrument should be completely immersed (preferably stored) in the solution for thirty minutes as a minimum. Sixty minutes is a better time period. As these solutions are irritating to the mucus membranes of the nose and also the conjunctivae, the instruments may be placed in 70% ethyl alcohol just before the operation.

Contrary to popular belief, sharp instruments can be safely autoclaved without ruining the cutting edge. The delicate edges or points should be protected by cotton or gauze covers to prevent mechanical injury, and also to absorb free moisture, which will otherwise cling to them and leave tarnish spots. Scalpel blades can be placed in a small medicine bottle, protected with cotton, the whole wrapped in muslin and sterilized for 15 to 20 minutes at maximum temperature of 250 to 254°F.

Glass Syringes

The syringe should be rinsed immediately after using and some clean water forced through the needle. This is particularly true if blood was drawn into the syringe. A stilette (piece of wire) is then placed in the needle after making sure that the point is in good shape. If not, the needle may be sharpened on a whetstone and cleaned with Bon-Ami, followed by benzene and ether.

The syringe should be taken apart and the parts washed thoroughly. It is then dried and the parts wrapped separately, and the whole wrapped in double thickness muslin. It is then exposed to 250-254°F. for 30 minutes, at fifteen to seventeen (15 - 17) pounds pressure.

An alternate method is to wrap the syringe in muslin with the barrel and plunger separated, and boil it for twenty (20) minutes.

Glass syringes (particularly the hypodermic type) may also be sterilized with dry heat (hot air oven).

Glass bulb syringes may be sterilized in a like manner.

Hypodermic Needles

Hypodermic needles can be sterilized in an autoclave or in the hot air oven. The needle with a stylet in the bore is placed in a special test tube, or protected with cotton, and stoppered with cotton (tightly if hot air oven is used). Sterilize for 20 minutes in the autoclave and for 1 hour at 320°F. in the hot air oven.

CHAPTER VII.

CARE AND STERILIZATION OF SPECIAL INSTRUMENTS

In the foregoing chapter the basic surgical instruments were discussed. In addition to these basic instruments many special instruments have evolved from the specialization of surgery. Among the most complex and important special surgical instruments are the telescopic type. As the name implies, these instruments contain a telescope or lens system. All are used in examining body cavities and in particular the interior of interval hollow organs. Instruments used to the same purpose but utilizing direct vision rather than a lens system, are known as endoscopic instruments.

Examples of Telescopic Instruments:

1. Cystoscope - for examination of bladder.
2. Thoracoscope - for examination of pleural cavity.
3. Peritoneoscope - for examination of contents of peritoneal cavity.
4. Gastroscope - for examination of interior of stomach.

Examples of Endoscopic Instruments:

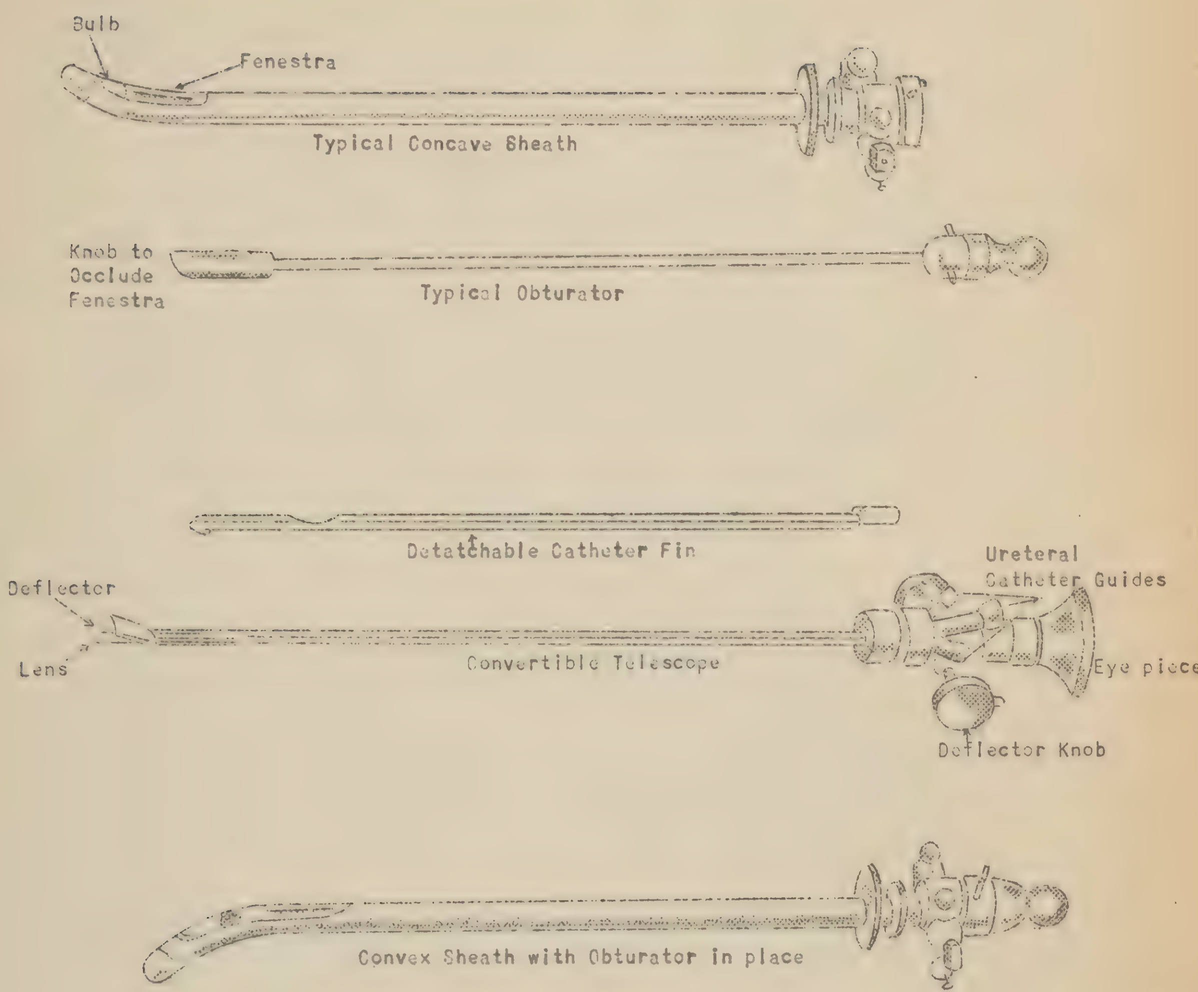
1. Bronchoscope - for the examination of interior of stomach.
2. Proctoscope - for examination of the rectum.
3. Laryngoscope - for examination (direct vision) of the larynx (voice box).
4. Anoscope - for examination of the anus.

The telescopic instruments in particular are highly complex and contain many details which through lack of attention can cause delays and aggravation to the surgeon. Nine-tenths of the difficulties encountered in the use of these instruments can be eliminated by an active procedure which prescribes careful attention to all details involved in the care, handling and preparation for use. These details whould be well learned by the technician.

To explain the mechanics and essential elements of a telescopic instrument, we will describe the cystoscope.

Mechanics: within the confines of an instrument, small enough to be passed through the urethra to the bladder, there is placed a complex arrangement, providing for light, irrigating system, vision and operation instruments or electrodes. A complete electrical circuit, of which the lamp (bulb) is a part, is present in the tubular portion of the cystoscope. The instruments

THE CYSTOSCOPE



have to be kept watertight as short and open circuits are almost entirely due to moisture leading into the electrical system. The technician must be sure the instrument is always kept watertight. The delicate lens system or telescope must also be kept watertight.

Essential Elements of a Cystoscope:

1. Sheath - this is tubular in nature, metallic and usually carries the lamp. This part of the instrument is in intimate contact with the mucus membrane of the urethra and should be carefully examined for any rough spots or abrasions. The sheath also contains the stop-cocks for the irrigating system.

2. Obturator - this part occludes the opening (fenestra) in the tubular sheath. The obturator should be placed in the sheath and the beak and fenestra examined for any protruding edges or sharp contours which would damage the tissues.

3. Telescope - this telescope is removable and contains an ocular (eye-piece), and a highly complicated optical system composed of many lenses and prisms which must be handled gently and with knowing care. It is through this portion of the instrument that the surgeon views the bladder. A convertible type of telescope is usually provided which allows the passage of one or two ureteral catheters or instruments.

The utmost care should be used to prevent a confusion of the parts belonging to one instrument with those of a similar instrument. In case an interchange of parts has occurred, no force should ever be used to fit corresponding parts together. Confusion of this nature can be avoided by carefully grouping all elements of one cystoscope together or by placing a distinctive mark on the parts. Do not mark the tubular portion of the sheath, however. Confine any identification marks to the lock or adjacent parts.

The efficiency of any telescopic instrument depends to a large extent on the cystoscopic accessories used with it. A thorough knowledge of their working principles is important to the technician

1. Illuminating Current Source
   a. Dry cell battery box.
   b. Transformer - ground free current reducing.
2. Irrigating System - water or a mild antiseptic solution (2% Boric) is used as an irrigating medium. This is allowed to run through the cystoscope, thus dilating the bladder and flattening out its folds, enabling the operator to view its entirety.

The system consists of essentially one or two glass percolators (jars) and gravity tubing leading to the cystoscope. A clamp or stop-cock is usually provided. Two percolators connected to a single gravity tube by means of a glass "Y" tube, insure a more constant supply of irrigating media and to a large extent eliminate unnecessary delay.

Preparation of Telescopic Equipment for Use

An impaired telescopic instrument means mechanical interference - distressing to both the patient and the surgeon.

With all the units, cystoscope, irrigator and light system properly arranged, it is necessary to test the assembled instrument before the examination of the patient is begun. The light system is probably most important. The surgeon usually checks this system before the instrument is passed to the bladder, but if he fails to do so and the light does not work properly, with the instrument passed, be assured that the surgeon will be mighty angry with the technician responsible.

1. Steps in testing the light system.
   a. After being certain that the current regulator on the battery box or transformer is set at its lowest point, connect the rubber covered cystoscope cord to the battery and to the rotating contact on the cystoscope.
   b. The regulator is then advanced until the light assumes the proper brilliancy. Observe the lamp filament closely while increasing the current. When the light suddenly changes from a reddish tint to white, the limit of safe current has been reached.

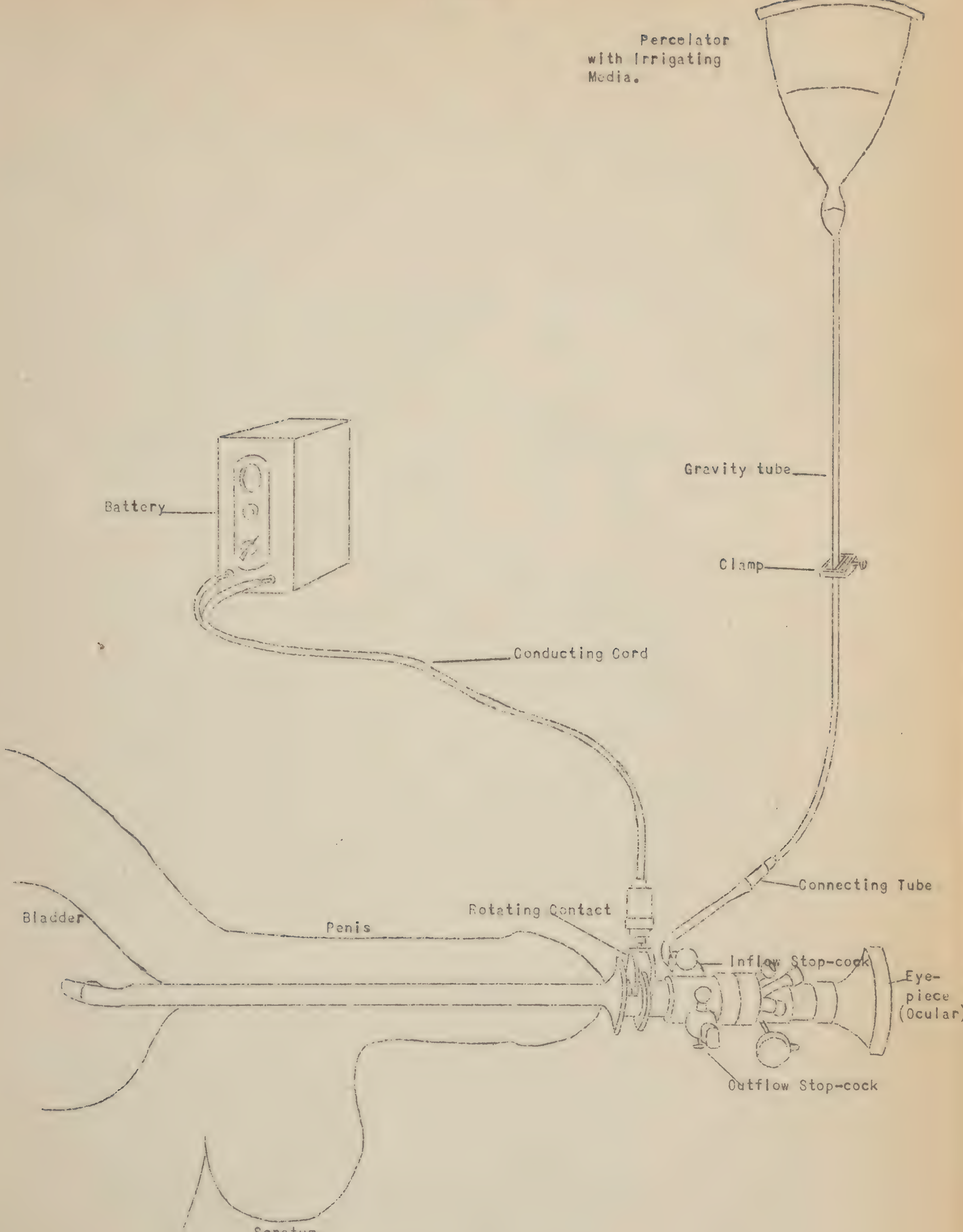
Sterilization of Telescopic Instruments

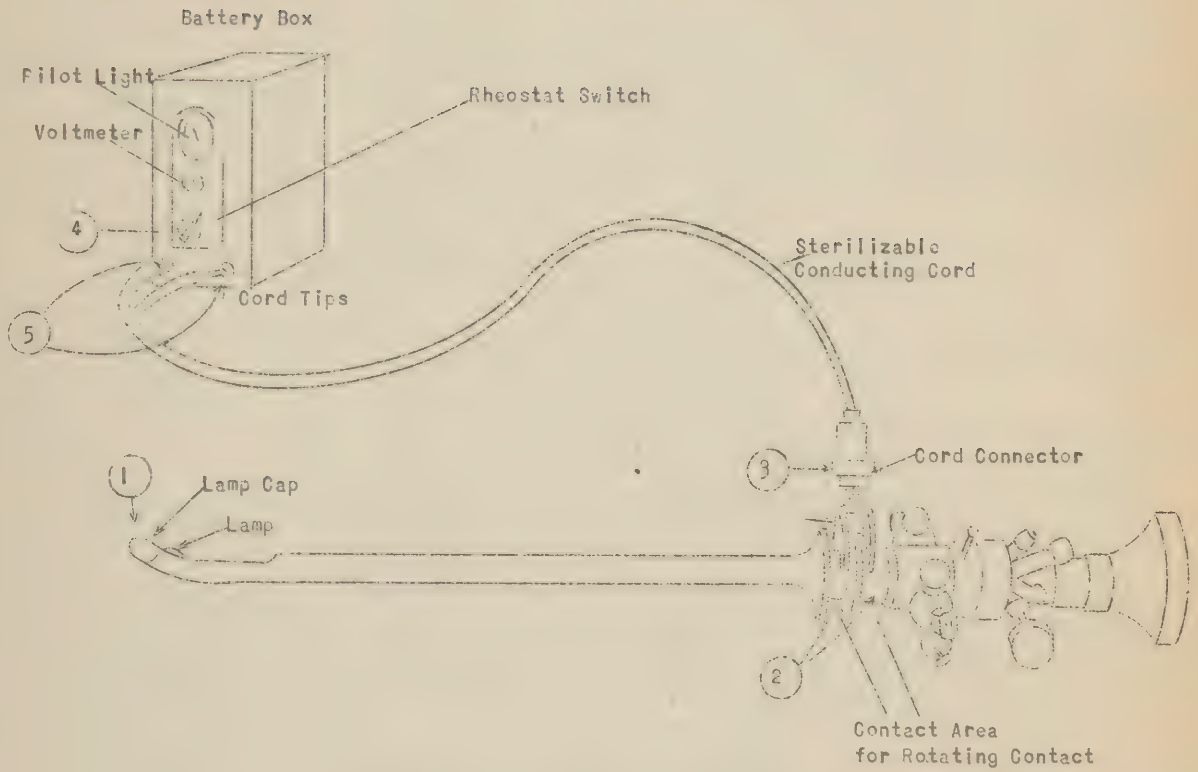
Before the proper procedure of sterilization of these highly complex instruments is discussed, the following "don'ts" are listed to avoid damage to the instrument. These statements are true for any telescopic instrument.

1. Don't boil any part of a telescopic instrument which contains lamps or lenses.
2. Don't place the instruments in alcohol. This will dissolve out the cement around the lens.
3. Don't place the instrument in carbolic acid.
4. Don't use benzine or ether to clean the lens.

The sterilization of telescopic instruments can be divided into three (3) steps: cleaning the instruments; immersion in the sterilizing solution; sterile storage in a formaldehyde vapor cabinet.

CYSTOSCOPE SET-UP





PARTS TO BE EXAMINED (NUMBERED IN THE ORDER OF THEIR IMPORTANT) IF CYSTOSCOPE FAILS TO LIGHT PROPERLY.

(ACMI BULLETIN)

1. Cleaning the Instruments:

a. After being used, the instruments are dissembled and rinsed in cold water.
b. All parts are thoroughly washed with cotton dipped in tincture of green soap, the crevices scrubbed with a soft brush, and the interior of the sheath swabbed out with green soap or a cotton-tipped cleaning rod and rinsed in running water. This is done to remove all oils, lubricating jelly, blood or secretions from the instruments.
c. To remove dried deposits of blood or lubricating jelly from the lenses, the end of a toothpick can be used. This may be moistened slightly with water - never use alcohol, ether, phenol or benzine.
d. Be sure to open all stop-cocks during the cleansing process and see that they remain open during the entire sterilization process.

2. Immersion in the Sterilizing Solution:

a. Place a towel or any similar resilient material in the sterilizing tray to prevent nicks, dents and surface abrasions.
b. Complete immersion of everything needed - obturators, telescopes, rubber light cord, tubber tips, etc., in either 1:1000 Mercury Oxycyanide or a 1:3800 solution of phenylmercuric acetate (Cystan) for 15 to 30 minutes. Never use an aluminum tray with Cystan. Endoscopic tubes and sheaths that do not carry lights or lenses, and other metal parts such as obturators and stop-cocks, may be sterilized by autoclaving or boiling.

3. Storage in Formaldehyde Vapor:

a. The instrument should be first cleaned and sterilized in Cystan, dried carefully and placed in the vapor cabinet.
b. Do not place moist instruments in a formaldehyde vapor cabinet.
c. Initial formalin sterilization (without previous immersion in a sterilizing solution) requires 2 hours.
d. Instruments should be rinsed in sterile water, before using, to remove all traces of formaldehyde.
e. After sterilization in oxycyanide of mercury or Cystan, the instruments may be dried carefully and placed in a formaldehyde storage cabinet.

Care and Maintenance of Catheters, Sounds and Bougies

Catheters are tubular surgical instruments for discharging fluids from a body cavity or for distending a body passage. The word is used more frequently, however, in reference to the urethral and ureteral catheters. Urethral catheters, as the term implies, are used in the urethra, the passageway from the bladder out through the penis. Its commonest uses perhaps are:

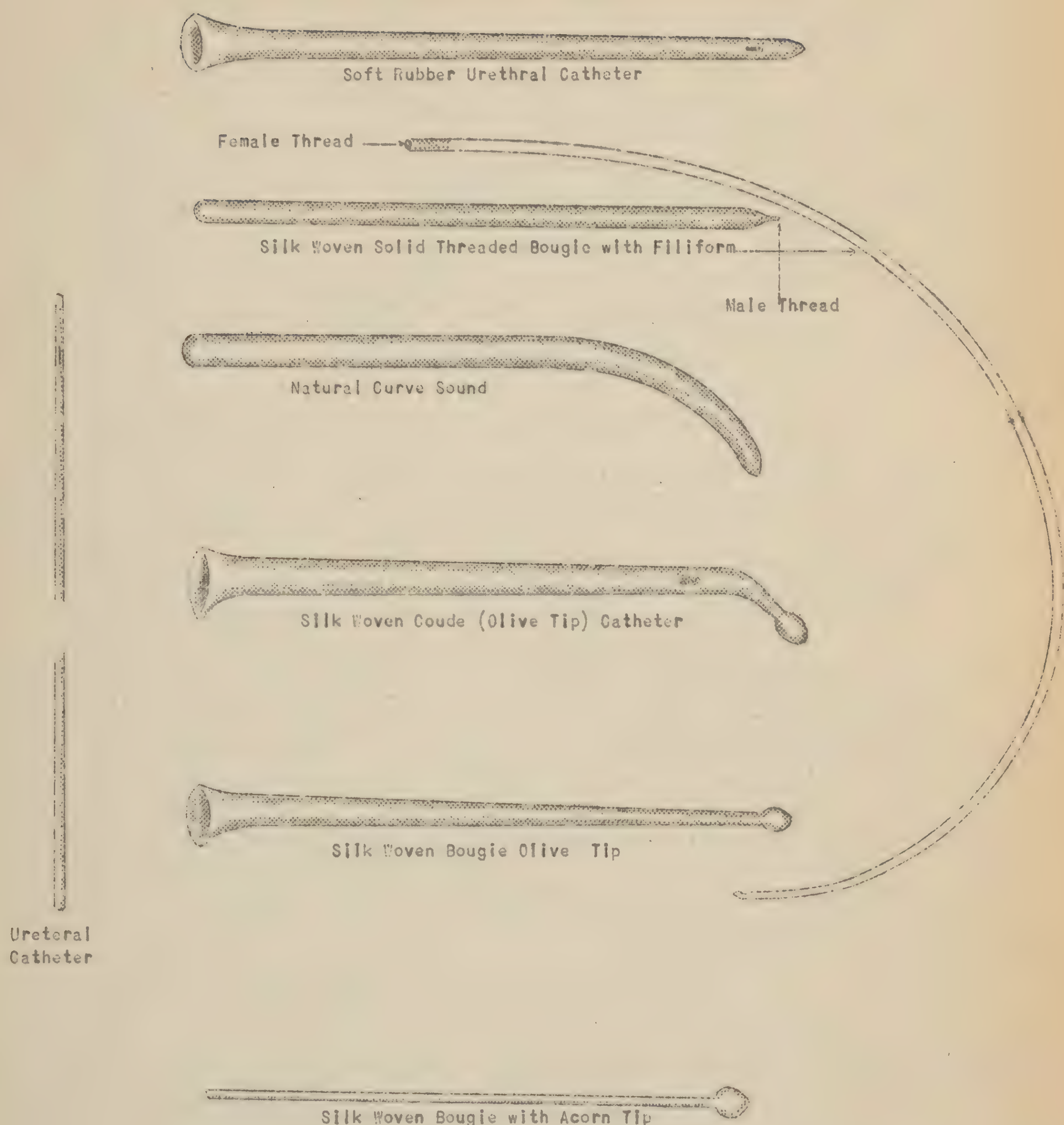
1. To obtain a sterile specimen of urine, particularly in the female.
2. To evacuate and determine the amount of residual urine in the male.

Other uses are (1) instillation of medicines, (2) bladder irrigation, (3) determination of the bladder capacity, (4) cystometry; (5) cystography and (6) continuous bladder drainage. Red, soft rubber, latex rubber, metal, woven silk, impregnated with gum and glass, are the materials commonly used in the manufacture of urethral catheters. The French scale is usually used in grading the size of catheters; the unit of measure being 1/3 mm. Ex.: a 30 Fr. catheter = 10 mm. in diameter. Catheters are usually manufactured in sizes from No. 10 French to No. 28 French.

Red Rubber (India) - red soft rubber catheters are relatively inexpensive, durable and practicable and are the type most commonly used at the present. They consist of a hollow tube with one funnel-shaped end and a laterally (on the side) placed eye near the other end, which is closed, and rounded or shaped like an olive (olivary). Numerous modifications of this shape have been introduced.

1. Cleaning: Red rubber (soft) catheters are cleaned immediately after use, by rinsing in cold running water, immersing in soapy water and then thoroughly washed. The lumen (hollow part of the tube) is cleansed by forcing water through it with a syringe.

2. Sterilization: they may be then sterilized by:
   a. Boiling for at least 5 minutes (not more than 10).
   b. Immersion in 1:1000 mercury oxycyanide for 15 minutes.
   c. Pressure steam (autoclave).
   d. 2 hours in a formalin cabinet (preferably overnight).
   e. Combinations of the preceding.



Soft Rubber Urethral Catheter
Female Thread
Silk Woven Solid Threaded Bougie with Filiform
Male Thread
Natural Curve Sound
Silk Woven Coude (Olive Tip) Catheter
Silk Woven Bougie Olive Tip
Ureteral Catheter
Silk Woven Bougie with Acorn Tip

Latex Rubber Catheters and Accessories:

1. Cleaning: latex rubber catheters should be washed with cold water and then green soap (scrubbed with a soft brush) as soon as possible after use. Water should be forced through the lumen with a syringe.

2. Sterilization: this may be accomplished by:
   a. Pressure Steam.
      (1) 10-15 minutes at 248°F. (15 lbs. pressure) for latex articles used in surgical cases.
      (2) 10 minutes at 240°F. (10 lbs. pressure) for latex articles used in other than surgical cases. Rigorous care must be exercised to remove all air from the pressure sterilizer. (See Chapter on Surgical Sterilization).
   b. Immersion in mercury oxycyanide for 15 minutes.
   c. Boiling water for 15 minutes - the water should be boiling before the catheters are immersed.

Don'ts for Soft Rubber Goods (ACMI)

Don't let soft rubber instruments be around in direct or diffused sunlight or even in bright artificial light. Keep them in a dark place.

Don't put heavy articles on them to cause sharp folds.

Don't expose to oxidizing agents (chlorine, sodium hypochlorite, chloramine, iodine, etc.).

Don't leave in any disinfectant solution.

Don't expose to oils, fats or greases. Never use vaseline or any other material having an oil base on the articles.

Don't let the rubber contact with the bottom of a direct heated vessel or heating unit during boiling, as it may, in places, be exposed to temperatures higher than the boiling point of water.

Don't sterilize in a mixture of steam and air. Flush the air out of the autoclave.

Don't place rubber goods in formalin gas sterilizer or formalin humidor unless they are completely dry.

Woven-Fabric Urethral Catheters:

These catheters are hollow tubular instruments made of a woven fabric (usually silk) which is impregnated with a special gum and carefully baked in an oven. They are safer than metal catheters and more rigid than soft rubber ones, but even with good care their useful life is shorter than the rubber and metal ones. Woven catheters come in various shapes and sizes and are of particular value in passing a moderate obstruction at the bladder neck.

1. Cleaning: - silk woven urethral catheters should be thoroughly cleansed with soap and water and dried with gauze or a clean, soft towel. Make sure that all particles of lubricant, blood, pus, etc., have been removed. Water may be forced through the lumen with the aid of a syringe.

2. Sterilization:

a. 15 minute immersion in 1:1000 mercury oxycyanide solution after which they are drained, dried and placed in sterile basins in the formalin cabinet. Should be rinsed in sterile water before using.
b. An alternate method of sterilizing silk woven catheters is immersion in 1:1000 mercury oxycyanide for 15 minutes, boiling for 1 1/2 minutes and then placing them in a formalin cabinet or expose them to steam under pressure. However, many makes of silk woven catheters will not stand boiling or autoclaving, so we do not recommend this procedure for Army installations.

Metal and Glass Catheters: are cleaned and sterilized in the same manner as are the ones of soft rubber.

Ureteral Catheters: these instruments are long, flexible, hollow tubes made of woven silk covered with shellac and usually have a solid, rounded tip. One or two eyes, near the tip, and an opening at the other end of the instrument, permit the passage of urine from the kidney pelvis or ureter through the lumen (opening) of the catheter, to a container placed at the open end. Of course, a cystoscope is necessary to pass ureteral catheters, the catheters being passed through the cystoscope and thence into the ureter via the ureteral orifices on the bladder floor.

Ordinary ureteral catheters vary in size from No. 3 to No. 12 French, Nos. 5, 6 and 7 French, being the sizes more frequently used. They are usually divided into centimeter lengths by marks on their outer surface. Ureteral catheters may be plain or impregnated with bismuth salts so as to make them x-ray opaque (will show up on the x-ray film). The latter are useful in locating stones in the ureter.

1. Cleaning:

a. Immediately after use a non-corroding stylet should be inserted in the catheter to prevent the lumen from becoming clogged with blood, pus or lubricant.
b. The catheter is then immersed in soapy water and its outside surface thoroughly washed.
c. The stylet is now removed and the lumen (tube) cleansed by repeatedly forcing soapy water through it with a syringe.

2. Sterilization of Ureteral Catheters:

   a. The catheter (or catheters) is placed in a tall jar (a graduate works well) filled with 1:1000 mercury oxycyanide (or Cystan) which is siphoned through it by suction, one end of the catheter being in the fluid and the rest of the instrument draining over the edge of a jar into a receptacle.
   b. After the sterilizing solution has drained freely through the lumen for 15 minutes, the catheter is completely immersed in mercury oxycyanide 1:1000 for 15 minutes to insure complete sterilization (inner and outer surfaces).
   c. Cold sterile water is forced through the lumen followed by air.
   d. It is allowed to dry and placed in a sterile humidor or formalin cabinet overnight.
   e. Before using they should be rinsed off with sterile water (if formalin is used).

3. Care: ureteral catheters should be frequently inspected for limp sections showing a deterioration (rottening) of the woven bases. These should be discarded. The surface also should be inspected for the presence of cracks or abrasions which might irritate the mucus membrane of the ureter.

Sounds:

Sounds are solid metal instruments, straight for females, but of varying shapes for males, the different curves being merely for the purpose of more readily passing certain types of obstruction and distortion of the urethra. Sounds are manufactured in graduated sizes from a No. 10 French, to a No. 36 French. The principal use of the sound is to dilate strictures (narrow areas) of the male urethra. A sound may have a thread at its tip, so it may be attached to a filiform bougie which has been passed (see Filiforms).

Sounds are washed thoroughly with soapy water, rinsed and either boiled for 20 minutes or autoclaved (like any metal instrument).

Bougies:

Bougies are solid, flexible instruments made of gum-impregnated woven fabric. Bulbed bougies, with acorn or olive tips come in various sizes. They are used to localize, calibrate and dilate strictures of the urethra (anterior). Bougies also may have a "male" thread so they may be attached to a filiform which has been passed in an occluded urethra. Ureteral bougies are used to localize and dilate strictures or other occlusions of the ureter.

Filiforms:

A filiform is a fine, wire-like instrument, properly a bougie, to which is usually attached a "follower" (sound or bougie) or dilator. This fine filiform is first passed by the tight occlusion (narrow strictured area) in the urethra and then the more rigid "follower" (bougie or metal sound) is attached and follows in its wake. Filiforms have a female thread to fit over the male thread on the metal catheter or sound. The most satisfactory filiforms are made of whalebone or rubberized silk-woven fabric.

Care, Cleaning and Sterilization of Bougies and Filiforms:

Great care must be taken to have the filiforms associated with their proper followers for the standard use in the size of the thread is not uniform. (German, English and French standards are used). No force should ever be used nor should the threads hang loosely together. As the filiform curls up in the bladder when the follower is in the urethra, if the two parts become separated (usually at the thread), an operation might be necessary to retrieve it from the bladder.

Bougies and filiforms are sterilized with the same methods recommended for the sterilization of silk woven (woven fabric) urethral catheters.

CHAPTER VIII.

SURGICAL TECHNIQUE

Modern surgery is a combination of aseptic and antiseptic surgery (Chap.II). Everything used at the time of the operation must be free from pathogenic bacteria (surgically clean). Constant vigilance is necessary before, during and after an operation and no "breaks" or failures in surgical technique must occur - or if they do occur, be allowed to pass uncorrected.

Asepsis in the Operating Room:

1. Surgical sterilization of gowns and gloves of the operating team and all instruments and materials that come in contact with the surgical wound or are handled by the surgeon and his assistants.
2. Precautions in scrubbing the hands and forearms of the surgeon and his assistants.
3. Precautions in putting on sterile gowns and gloves.
4. Careful preparation (chemical sterilization) of the patient's skin (the operative field).
5. Precaution against contamination by dust and flies,etc.
6. Prevention of perspiration dropping from the face and neck of the surgeon and his assistants.
7. During the operation the surgeon and his assistants must not touch anything that is not sterile. The smallest "Break" in technique may turn a mechanically perfect operation into an ultimate complete failure.

Technicians, before they can be said to be efficient in the Operating Room, should be familiar with the following points of Surgical Technique:

1. Surgical Sterilization (Chap.IV).
2. Operating room caps: these are caps of unbleached muslin in several styles and sizes. They must be placed on the head so as to come well over the occipital protubrance, covering all of the hair. The cap is not sterile.
3. Face masks are made of oblongs of gauze or other material with 4 tapes which are tied at the top of the head and the back of the neck. Both the nose and the mouth must be covered by the mask. The operating room cap and mask are put on by everyone working in the operating room before they enter the room. Those of the operating room personnel that "scrub-up" put on the cap and mask before starting the "scrubbing-up" procedure.
4. "Scrubbing-Up" - many different methods have been recommended and while none are capable of making the hands germ free, most of them will give satisfactory results. In all the methods there are two steps: first, mechanical cleaning with soap, water, brush and nail stick; second, chemical sterilization (soap also affords some chemical sterilization).

An excellent method of mechanical cleansing is as follows:

a. Nails are trimmed.
b. Hands, forearms and arms to a point three inches above the elbow are washed off with green soap and tepid water.
c. Remove all dirt from beneath nails with an "orange wood" stick or nail file, allowing water to run over the hands during the process.
d. Starting at the tips of the fingers, the hands, forearms and arms, to a point two inches above the elbows, are scrubbed with a sterile brush, green soap and running warm water. This washing should be done methodically so that each side (the finger has four sides) of the fingers, the hands and forearms, etc., are scrubbed thoroughly. 2 1/2 minutes should be spent on each hand and forearm. All soap rinsed in running water.
e. Nails again cleaned with a sterile "orange wood" stick under running water.
f. Step d repeated with another sterile brush, except that fingers, hand and forearm only are scrubbed. Do not go above the elbow this time.
g. After thoroughly rinsing off all soap with the aid of copious amounts of running water, the upper extremities are held in position with the elbows flexed and the hands about level with the tip of the nose. This position is assumed so that the water will drip from the elbows rather than run down the forearm and off the hands.

The person who is scrubbing up is now ready for chemical sterilization of the hands and forearms. Numerous solutions have been, and still are, used for this purpose. Bichloride of mercury; 70% alcohol, cresol preparations, iodine, followed by alcohol, etc., are just a few of the many. These solutions may be contained in basins in the operating room. The hands and forearms are usually completely immersed for two minutes or they may be just thoroughly covered with the solution (gauze, sprays, etc.).

5. After scrubbing and rinsing in the chemical solution, the hands and forearms may be dried with a sterile towel, the hands only may be dried, or neither may be dried. A sterile gown is then put on.

6. Putting on sterile gown unassisted:

a. Pick up entire gown off the table, being careful not to touch any portion of the gown except the back of the neck band.

b. Holding back of neck band with both hands, allow the remainder of the gown to unfold itself (gravity). Make certain that no portion of the gown touches the floor or any surrounding objects.
c. Holding the rear of neck band with the right hand, the left hand is placed in the left arm hole and run down the sleeve as far as it will go. Then, do the same with the right. Make no attempt to pull the sleeves up on the arms - this is a break in technique. Hold upper extremities up.
d. Unsterile nurse or technician will then fasten the ties on the gown after she has pulled the sleeves of the gown by placing her hands on the inside of the upper portion of the sleeve. In tying up the waist band, the unsterile technician must not allow the ends of the ties to fly about thus contaminating the remaining sterile parts of the gown.

7. Putting on Sterile Gown Assisted:
   a. The sterile nurse holds the front of the gown by the shoulders with the neck band folded back over her gloved hands. The back (inside) of gown is thus towards the person who is ready to put on the gown.
   b. The hands are then placed in the arm holes and run into the sleeve with a downward and outward motion, being careful not to touch the person holding the gown.
   c. The remaining steps are the same as Step d above, (putting on gown unassisted).

8. Putting on Gloves Unassisted:
   a. Gloves should be shaken out of the pocket on to a sterile table.
   b. Gauze removed from palms without touching inside of the gloves.
   c. Hands well powdered, making sure inner sides of fingers are powdered.
   d. The right glove is picked up by the opper part of the folded cuff with the left hand. The fingers of the right hand are then placed in the glove, which is pulled on to the hand by the left hand. The cuff should not be unfolded (to cover over gown at wrist) until left hand has been gloved.
   e. The fingers of the gloved right hand are then slipped under the upper portion of the left glove. The fingers of the left hand are placed in the glove which is pulled up by the right hand. Be careful not to touch the inside of the left glove with the gloved right hand.

f. The cuff of the right glove is pulled over the wrist by putting the fingers of the gloved left hand in the cuff at the dorsum of the hand (back) and then pulling up.

9. Putting on Gloves Assisted:
   a. The sterile technician or nurse will first remove gauze from the inner palms of the gloves.
   b. Then the right glove is grasped in such a manner that the palm is away from the person being gloved. With the top of the glove spread widely, the powdered hand is then placed in the glove, the fingers set in their proper places and the glove snapped on the hand by a downward motion of the hand while the assistant is pulling up.
   c. The left hand is gloved in a similar manner.

10. Preparation of Operative Field:

This is a matter of major importance. The area has usually been well shaved and cleansed with green soap the night before the operation by the technician on the ward. However, the area should be examined to see if all hair was removed. The shaving may sometimes be done in the operating room. If a general or spinal anesthetic, etc., is used, the skin preparation is done after the patient is anesthetized. With local infiltration or nerve block, the field is prepared before the injection of the anesthetic agent.

Many solutions and combinations of solutions are used to chemically sterilize the skin of the field of operation. The solution used may be capable of destroying the bacteria without destroying the tissues and be economical. A simple method is to scrub the skin with a gauze "prep" sponge wet with ether to remove grease and moisture and then paint the skin with same solution like 3.2% Tincture of Iodine (followed by 70% alcohol after iodine dries), Scott's Solution, Merthiolate or Mercretone.

In "prepping", one should always start in the middle of the field and progress outward to the edges, never moving centerward again with the same sponge. Only use as much solution as is needed; do not allow it to run around to the back (if you are preparing for an abdominal operation) or to puddle so as to wet the drapes. Be especially careful with iodine; make sure that you remove it with alcohol.

Prepare a wide area.

11. Draping:

The patient is draped with drape sheets, towels and laparotomy sheet (or similar sheet, depending on type of operation) by the scrub nurse and the first or second assistant. One drape sheet is placed from the operative site over the lower extremities and one goes from the operative site to cover over the upper part of the body (except face). These drape sheets are wide enough to hang well over the sides of the operating room rable. Next, towels are placed about the operative site and held in place with towel clamps. The laparotomy sheet is then placed with the short end (from the opening) being the head end. In this manner, only a small area of prepared skin is left exposed.

12. Sponge Count:

One of the most important duties of the scrub nurse and circulating nurse (or technician) during an operation where a cavity is opened, is to keep count of the sponges used. The scrub nurse and circulating nurse must have some tally system whereby the number of sponges used and the number of sponges left unused on the table exactly equal the number of sponges given to the scrub nurse. The sponge count should be correct before the abdominal cavity is closed for sponges and instruments have been left in the cavity. A good plan is never to use small sponges after the peritoneal cavity has been opened and to have large sponges with rings on them for use in the abdomen.

Common"Breaks" in Surgical Technique:

1. Hair not covered by cap.
2. Nose not covered by mask.
3. Sutures allowed to hang below the field of operation. Only the top side of the draped patient, in the vicinity of the operative site, is considered as being actually sterile.
4. Gloved hands allowed to fall to side.
5. Instruments passed behind someone's back - no excuse for this failure in technique.
6. Contamination at head of table.
7. Attempting to prevent instruments from slipping off the side of the table. Once the instrument is past the actual top of the operative field, it is not considered sterile any longer.

Operating Room Personnel:

1. Operator - surgeon)
2. First Assistant) - Medical Officers
3. Second Assistant)
4. Scrub-nurse - female nurse or technician.
5. Technician (1 or 2) - enlisted men.
6. Operating Division Supervisor - female nurse.
7. Anesthetist - trained nurse or medical officer.

The preceding set up may be modified, depending on the size of the installation and the surgeon's desires.

The operating surgeon is in complete charge of the operating room. He is responsible for the patient's life and for the successful outcome of the operation. He is held accountable for any mistakes and accidents, no matter whose fault it may be.

The first assistant usually stands directly across from the surgeon, clamps bleeding vessels, places ligatures (or removes clamps after surgeon places them), and in general helps the surgeon throughout the operation.

The second assistant cuts the suture and ligature ends, and sponges the blood in the wound, retracts the wound edges and again in general helps out the first assistant and the surgeon. He assumes a position alongside of the first assistant across from the scrub-nurse.

<u>Duties of the "Scrub-Nurse"</u>: in the large stations a member of the Army Nurse Corps, or a civilian nurse, will probably be the scrub-nurse. However, in many stations, particularly in the field, the technician will act as the scrub-nurse. The following are the duties of the scrub-nurse, listed more or less in chronological order.

1. Selects the instruments and surgical supplies to be sterilized.

2. Removes outer clothes; puts on operating room clothes (includes cap and mask) and proceeds to scrub-up. Puts on sterile gown and gloves.

3. Drapes, with sterile table cover, toweling or pillow cases, the small instrument table, the reserve instrument table, the table for gowns and gloves, the "prep" table, the spinal anesthetic table (if spinal is to be used) and the basin (splash) standards. Two thicknesses of material must be used.

4. Arranges sterile instruments (brought by technician) on the small adjustable) instrument table and the reserve instrument table. These are covered with a sterile towel until needed.

<u>General Arrangement of Instruments on Small Instrument Table</u>

Holding and Retracting 3	4 Suturing and Probing
2 Hemostatic	1 Cutting

(The handles of the instruments are directed toward the operator and the instruments are placed, as nearly as possible, in the order they will be used.

5. Arranges contents of the sterile packages which were placed on the table (and opened) by Circulating Technician.

6. Prepares needles, sutures and ligatures. Sutures and ligatures are kept in a dry towel and dipped in water for a few seconds immediately before handing them to operator.

7. Accounts (with the Circulating Technician) for all sponges on the tables.

8. Contents of basin and utensil set placed in their proper places.

9. Assists the surgeon and his assistants into their gowns and gloves.

10. Assists with the spinal anesthetic (if spinal anesthesia is to be used).

11. Assists in preparing the field of operation (operative site) in the manner described above.

12. Assists in draping the patient with drape sheets, towels and laparotomy sheet.

13. Passes the scalpel to the surgeon - the operation begins.

14. Passes all instruments, sponges, sutures, ligatures, etc., to the surgeon and his assistants. Anticipates the surgeon's needs. Ample supplies, warm solutions, etc., must be on hand. If something is needed, the Circulating Technician is at hand to assist.

15. Account for all sponges - before the abdominal (or any) cavity is closed. Check this count with the Circulating Technician.

16. Assists with the surgical dressing.

17. Soiled instruments collected and taken to the work room to be cleaned and sterilized.

Duties of the Technician in the Operating Room: the technician takes the place usually of the so-called Circulating Nurse of the civilian hospital. He does not scrub-up or put on a gown and gloves (unless he is the scrub-nurse), but does have on a cap and mask properly placed.

1. Furniture and equipment placed in the proper order and the walls, overhead lights, tables, etc., are wiped down, using a cloth moistened with cresol solution. These are never dusted.

2. Sterilizes instruments, etc., that were selected by the scrub-nurse.

3. Places the necessary packs of supplies, gloves, gowns, etc., on the proper tables and opens them at the scrub-nurse's request.

4. Assists Anesthetist.

5. Sterile instruments, in trays, are brought in and turned over to the scrub-nurse.

6. Checks sponge count with scrub-nurse.

7. Ties up gown of surgeon and his assistants.

8. Keeps floor clean of soiled sponges, instruments, etc., during the operation.

9. Wipes perspiration from brow, face and neck of the operator and his assistants. This is done with a piece of gauze or towel, making sure there are no loose ends to contaminate the surgeon's gown. If one of the operating team does have perspiration, which is liable to drop on the field, the Technician should approach him from behind and touch him on the back. This would be a signal for the person to turn his face toward you. Then mop from the front mid-line around to the back. The head is then turned toward the other direction and the procedure is repeated. Never wipe off the forehead while the surgeon is leaning over the operating table. If glasses are worn and need cleaning, remove them, clean them and replace them.

10. Refrains from loud talking, laughing, joking, etc., in the operating room.

11. Remains in the operating room at all times and anticipates the needs of the scrub-nurse. Hands sterile supplies and instruments to the scrub-nurse with the aid of "pick-up or handling" forceps. Never hold the "pick-up" forceps with the point upward, for this causes the sterilizing solution (in which it is kept,) to roll up over the handle and hand, which are unsterile. In lowering the point again, this solution runs down and contaminates the sterile portion of the instrument.

In pouring solution, remove the gauze cap and pour a bit of the solution out into a floor receptacle before pouring the solution into a sterile basin, etc. This will tend to cleanse the lip of the flask and thus reduce the chance of contamination.

12. Checks sponge count with scrub-nurse before the abdominal (or any) cavity is closed.

13. Has adhesive strips or ties ready for use on the surgical dressing and assists in placing them.

14. Assists anesthetist in returning patient to the ward.

15. Cleans room after the operation.

   a. All tables are stripped, cleaned and dried.
   b. Contaminated articles are stacked, ready to take out.
   c. Floor basins are emptied into one basin and the contents removed from the room.
   d. Used linen is collected and placed in a wheeled hamper. It is then taken to the work room and sorted for laundering.
   e. Lights are turned off and all electrical apparatus disconnected.

To the Operating Division Supervisor is delegated the authority necessary for the routine administration of the operating suite. This appointment is usually held by a member of the Army Nurse Corps. It involves numerous details such as the care and accounting of all property, sterilization of instruments, surgical supplies and solutions (usually for the whole hospital), preparation for operations, supervision and instruction of technicians, and keeping everything running smoothly at all times.

The Anesthetist may be a nurse who has received special training or a medical officer. He or she is responsible to the operating surgeon for the general condition of the patient during the administration of the anesthetic. If spinal anesthesia is chosen the surgeon or one of his assistants may administer the anesthetic agent. An anesthetist or experienced nurse or technician should sit at the patient's head during the operation and keep check at frequent intervals of the blood pressure, pulse and respirations.

Preparation for Operation

Each one of the operating room personnel removes his outer clothes and puts on his operating room clothes, cap and mask. The surgeon, first assistant, second assistant and scrub-nurse will scrub up and don sterile gowns and gloves. The circulating technician, anesthetist and the operating division supervisor, wear caps and masks but do not scrub up or put on sterile gowns and gloves.

1. Scrub-nurse selects instruments and supplies needed for the operation and asks the technician to sterilize the non-sterile articles.
2. Technician then arranges and cleans the room and its contained equipment.
3. Technician brings packages of sterile goods from the supply room and puts them on the proper tables.
4. Surgeon and his assistants and the "scrub or sterile" nurse proceed to the wash room to scrub up. The scrub-nurse will usually scrub before the surgeon, etc., for he, or she, has many duties to perform after he, or she, has donned a sterile gown and gloves.
5. Scrub-nurse dons sterile gown and gloves from a package (on the proper table), which has been opened by the Circulating Technician.
6. Tables, basin standards, etc., are draped.
7. Trays of sterile instruments are brought in from the sterilizer by the technician and arranged on the sterile instrument tables by the scrub-nurse. Sutures and ligatures fixed and placed in a dry towel.

8. Basin and utensil set opened and contents placed in their proper places.

9. Remainder of sterile packages opened by the technician and their contents properly placed on the reserve table.

10. Spinal tray is set up, if spinal anesthesia is to be used.

11. All tables and stands containing sterile articles are draped with sterile towels or table covers until the articles are to be used.

12. The patient is brought into the operating room. Anesthetic is administered. Technician stands by if general anesthetic is being administered or holds the patient in the proper position, if a spinal is being given.

13. Surgeon and his assistants have scrubbed and enter the operating room ready to be assisted into sterile gowns and gloves. The second assistant may put on only a pair of gloves which he changes after "prepping" the patient. If the first assistant or surgeon has administered the spinal anesthetic, he will probably change his gown and gloves for new ones before beginning the operation proper.

14. Operative site (patient's skin) prepared by the second assistant in the manner described above.

15. Patient (and operating table) draped by one of the assistants and the scrub-nurse.

16. The small instrument table is rolled into place as are the basin stands. The small instrument table (without instruments) may be placed above the patient's thighs and included in the general draping of the patient, following which the instruments are arranged properly.

17. Surgeon and his assistants assume their proper places.

18. Scrub-nurse hands the scalpel to the surgeon and the operation proceeds.

CHAPTER IX.

ANESTHESIA

The introduction of anesthesia and the development of various anesthetic agents has been one of the greatest aids in the rapid progress of surgery. Opium and alcohol seemed to have been the chief means by which ancient surgeons dulled the pain of surgical operations.

The real beginning of surgical anesthesia was in 1846 when Morton first demonstrated the administration of ether in Boston. Dr. Crawford W. Long of Jefferson, Georgia, in 1842, noticed that the "gay blades" about his home who inhaled ether, at the then common "ether frolics", became insensible to pain. He administered the drug to a patient and removed a tumor of the neck. He did not, however, publish his discovery, so Morton gets official credit for being the first. A month after Morton's demonstration, Oliver Wendell Holmes coined the word "anesthesia" to describe this state of insensibility to touch. The following year, 1847, chloroform was used successfully by Sir James Y. Simpson of Edinburgh, Scotland. Chloroform has since been found to produce serious disease of the liver and has been practically eliminated as an anesthetic agent.

Local anesthesia was first introduced in 1884 by Karl Koller of Vienna who used a solution of cocaine in the eye.

Spinal anesthesia was first introduced into this country in 1900 but due to the high death rate was shunned until about 1928, when improved technique greatly reduced the death rate and the use of spinal anesthesia has increased rapidly.

The anesthetic properties of nitrous oxide were discovered in 1799 by Sir Humphrey Davy, but little was done with it until the latter part of the nineteenth century. The year, 1925, marked the beginning of a series of developments in anesthesia. There followed new gases and drugs to be used for anesthesia (ethylene, 1925; avertain, 1929; cyclopropane, 1934; evipal, 1934; sodium pentothal, 1937).

Anesthesia is now a very definite field of medicine manned by physicians who devote all their time and energies to the subject.

Definitions:

Anesthesia: means the complete loss of feeling or sensation of part or the whole of the body. It is artificially induced by the administration of some drug.

General Anesthesia: a total loss of consciousness due to the effects of the anesthetic agent on the central nervous system. Such a condition may be produced by the absorption of the chemical into the blood stream by:

1. Inhalation of gases and ether.
2. Absorption of drugs placed in the rectum.
3. Intravenous injections of certain drugs.

Local Anesthesia: is the complete loss of sensation to pain and other external stimuli, in a limited (or local) area. This is secured by paralyzing the nerve ends with (1) freezing with Ethyl Chloride; (2) introducing a drug like novocaine directly into the tissues; (3) obtaining what is known as Regional Anesthesia by spinal, sacral, paravertebral, or brachial injections of novocaine or similar agents. In Regional Anesthesia the anesthetizing fluid is injected about the nerve or nerves carrying sensation from a certain area.

The choice of the anesthetic will depend on the type of operation planned and the patient's age and general physical condition. An anesthetic to be ideal must:

1. Be easily taken into the system.
2. Produce the least danger to life.
3. Afford the maximum freedom from pain, shock and post-operative complications.
4. Permit the necessary relaxation during the operation.

In the general hospitals and larger station hospitals, the anesthetic will be administered by a medical officer or a nurse-anesthetic. In the field units and in the smaller permanent installations, however, the technician may act as assistant anesthetist or in rare cases, take entire charge of the anesthetic. The administration of the anesthetic should be done by one not only skilled in the mechanical administration of the agent, but also experienced in the systemic and physical changes which occur or may occur. He should have the basis knowledge to enable him to recognize complications early and treat them promptly. It is easily understood that we cannot make anesthetists of you with one or two short lectures. We intend only to acquaint you with the various anesthetic agents and the mode of their administration.

Types of Anesthesia and Anesthetic Agents

1. General Anesthesia - as stated above, general anesthesia represents a total loss of consciousness of such a degree that an operation can be performed without suffering and interfering movements on the patient's part. All the chemicals used reach the central nervous system (actually the entire nervous system) via the blood stream.

a. Inhalation - the volatile anesthetics like <u>ether</u>, <u>chloroform</u>, <u>nitrous oxide</u>, <u>ethylene</u> and <u>cyclopropane</u> are introduced into the blood stream by inhalation. That is, the gas is inhaled, goes to the lungs and is picked up there by the pulmonary circulation, carried from the lungs to the heart and thence to the central nervous system via the general circulation.

Ether is administered by the drop ether mask, the semi-closed or towel cone, the closed method with a gas machine face mask or the insufflation methods, intrapharyngeal and intratracheal (by the use of tubes). Equipment necessary for the administration of ether is (1) towel cones (2) large-sized metal or rubber oral airway (3) tongue forceps (4) vaseline (5) a piece of rubber dam large enough to fit over the eyes (6) castor oil to place in patient's eyes (7) glass finished rubber nasal tube with angular, smooth-edged tip (8) 1/2 pound of chemically pure ether (9) cotton (1) safety pin (11) cork to fit into mouth of ether can (12) knife.

Gas Anesthesia:

(1) Nitrous Oxide.
(2) Ethylene.
(3) Cyclopropane.

The above cases are usually given in conjunction with oxygen and carbon dioxide. The gases may be used alone or in conjunction with ether. The development of efficient gas machines has placed the gas mixtures with or without ether, or with novocaine infiltration, in the first rank, as the most serviceable means of anesthesia in the most severe types of operation.

b. Rectal Anesthesia - drugs placed in the rectum are absorbed into the general circulation and exert their effects on the central nervous system.

(1) Avertin (Tribromethyl alcohol) - this drug produces anesthesia and is supplemented with ether or one of the gases. The dosage is usually 80-100 milligrams of avertin per kilogram of body weight. Each cc. of avertin fluid represents 1 gram of avertin dissolved in 1 cc. of amylene hydrate.

(2) Avertin Equipment:

(a) Avertain fluid.
(b) Congo-red for testing solution.
(c) 10 cc. syringe with 18 gauge spinal needle.
(d) Avertin table of dosages.
(e) 30 ounce graduate.
(f) Glass flask for mixing.
(g) Thermometer.
(h) Rectal tube and funnel.

(3) Ether in oil also may be administered via the rectum (Gwathmey Analgesia).
(4) Evipal and Pentothal are occasionally used as rectal anesthetics and produce basal anesthesia.

c. Intravenous Anesthesia - the chemicals are introduced directly into the circulation by injection into a superficial vein and are carried to the central nervous system where they exert their influence. The drug most used at present is a barbiturate: Pentothal (Pentothal sodium). Pentothal is now being used in long major operations and works well in conjunction with local infiltration of novocaine. Pentothal is quite practicable for use in the field. It is particularly advantageous for field work.

Pentothal:
(1) Sterile table.
(2) Two (2) sterile towels.
(3) Ampule of Pentothal (1.0 Gram)
(4) 20 cc. glass syringe with a 20 gauge intravenous needle.
(5) 100 cc. of sterile distilled water.
(6) 4" x 4" gauze sponges.
(7) Sterile medicine glass.
(8) Padded arm board.
(9) Adhesive tape.
(10) Sterilizing solution (Tincture Merthiolate, Iodine and Alcohol, etc.).
(11) Atropine sulfate and/or Picrotoxin with 2 cc. syringe and hypodermic needle. Atropine Sulfate (.004 or .006 Gm.) is usually given pre-operatively. The important complication here is respiratory depression and/or laryngeal spasm.

2. Local Anesthesia:

a. Local Infiltration - this means the introduction into the tissues over a circumscribed area of a drug, usually novocaine or procaine (1/2 - 2 per cent), which paralyzes the superficial nerve endings. A 10 cc. syringe and needles (hypodermic to #21) are all that is needed.

b. Regional Anesthesia - secured by blocking large sensory nerves. The drug is injected about the nerves carrying sensation from a particular area.

(1) Spinal Anesthesia - in this type of anesthesia, drugs are introduced beneath the dura mater of the spinal cord in the lumbar region and paralyze chiefly the posterior sensory nerve roots. Accordingly, this affords insensibility to those areas corresponding to the distribution of the affected nerves. Remember that the patient is not unconscious after a spinal anesthetic. It is not a general anesthetic. Many drugs are used as spinal anesthetics with perhaps novocaine crystals being the most popular. Strovaine, tropocaine, spinocaine, neocaine, nupercaine, metycaine and pontocaine, are others in use at the present time. Each has its advocates and objectors. A vasoconstricting drug is usually given before the anesthetic is administered.

(a) Equipment for Spinal Anesthesia:
Sterile table.
Ampules of the anesthetic agent.
10 cc. and 5 cc. syringes.
1 1" and 1 1 1/2" hypodermic needles.
1 20 gauge needle.
1 19 gauge steel 3 1/2" spinal needle.
2 towels.
1 spinal sheet
Small gauze sponges.
Sponge forceps.
Container for 1% novocaine.

(b) Administration of Spinal Anesthetic.

(1-a) The patient is placed on his side with the shoulder and buttocks flush with and perpendicular to the edge of the operating table, the knees drawn up toward the patient's chin. The patient is held firmly by the technician - with one hand on the neck and the other hand and forearm behind the flexed knees.

(2-b) The skin of the lower back is prepared by the use of some antiseptic sterilizing solution (iodine and alcohol, Scott's Solution, Mercretone or Tincture of Merthiolate).

(3-c) At the center of the depression between the third and fourth (or second and third) vertebrae, 1% novocaine is injected subcutaneously for local anesthesia. This space (3rd) usually corresponds to the line of the iliac crests.

(4-d)Lumbar puncture is done using the 3 1/2" spinal needle.

(5-e)As soon as spinal fluid is obtained as much as is needed for dilution of the novocaine crystals is withdrawn. If a liquid anesthetic agent is to be used, the spinal fluid withdrawn (same amount as the drug to be injected) may be discarded, or in some cases no spinal fluid is withdrawn.

(6-f)The anesthetic agent or drug is injected through the spinal needle into the spinal canal at the rate of 0.5 cc. per second.

(7-g)Spinal needle withdrawn and small sterile dressing applied over the puncture wound.

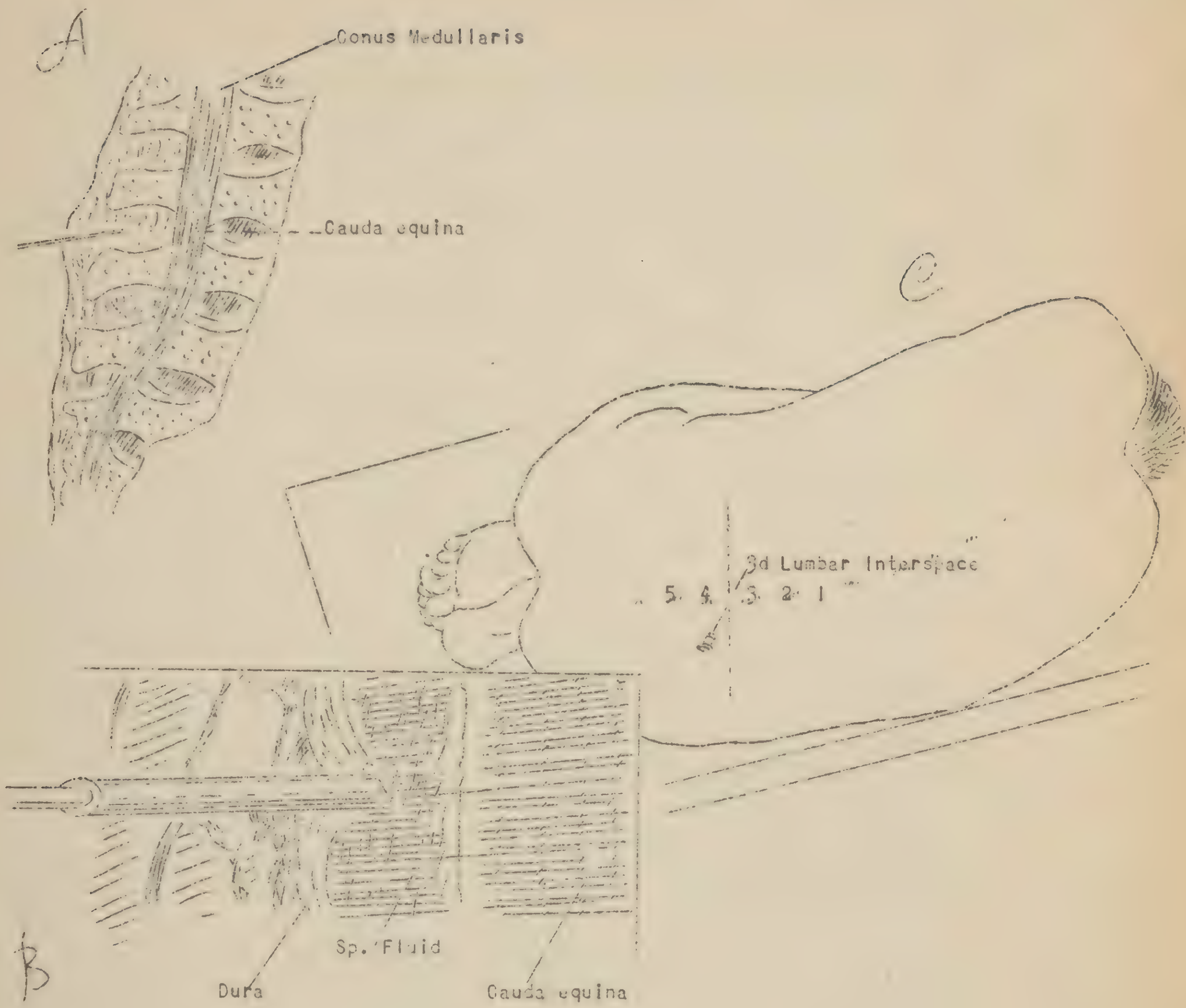
(8-h)Patient's legs extended, and if the drug used was lighter than spinal fluid, he is turned on his abdomen. If the drug is heavier than spinal fluid, he is turned on his back. This is done to bathe the posterior sensory nerve roots with the drug. The patient is usually left level unless a very low anesthetic (operations on anus, perineum, lower extremities) is desired. By adjusting the level of the operating table (depending on the weight of the drug) the desired level of anesthesia can be obtained.

(9-i)The level of anesthesia is now tested by applying a pin from the lower extremity upward and watching the facial expressions of the patient. Within 2 to 5 minutes the desired height of the anesthesia is obtained.

Patient placed in position desired for operation. In 15 minutes Trendelenburg Position (head well below feet) may be allowed, if desired.

Complications: the important complication here is primary shock with a fall in blood pressure and a weak, rapid pulse, nausea and vomiting. This should be treated with Ephedrine Sulfate, oxygen inhalation and intravenous infusions.

(2) Nerve-Block - an example of this would be the infiltration of the region of the inferior dental nerve to render anesthetic one side of the mandible. This is utilized in extracting teeth.



A. Infiltration with novocaine of the 3d lumbar interspace.

B. The spinal needle passing through the Dura.

C. Position of the patient for insertion of the needle.

(Homan's Surgery)

(3) Paravertebral Anesthesia - spinal nerves as they leave the vertebral foramina are blocked, thus producing a large one-sided anesthetic zone.

(4) Sacral Anesthesia - nerves leaving the sacral foramina are blocked with an anesthetic agent.

Preparation for Common Anesthetic Emergencies

1. Have routine circulatory and respiratory stimulants on hand.

a. Circulatory Stimulants.
   (1) Adrenalin (Epinephrine).
   (2) Coramine.
   (3) Neosynephrin.
   (4) Ephedrine Sulfate.
   (5) Pituitrin.

b. Respiratory Stimulants:
   (1) Caffeine-sodium-benzoate.
   (2) Picrotoxin.
   (3) Coramine.
   (4) Metrazol.
   (5) Atropine Sulfate.

2. Have intravenous outfit with 10% Glucose in water nearby.

3. For respiratory failure.
   a. Artificial Respiration - Silvester's method of raising arms above the head until air ceases to enter the lungs, then bringing arms down to side, may be used. Also alternate pressure may be applied under the drapes to the lower ribs.
      (1) Oxygen - carbon dioxide machine.
      (2) Respiratory stimulants.
      (3) Pull tongue out of mouth with tongue forcep.

4. Cardiac Failure.
   a. Surgeon massages heart.
   b. Adrenalin directly into heart by using a 3 1/2" needle.
   c. Routine circulatory stimulants.

5. Shock.
   a. Routine treatment with blood transfusion, hypertonic glucose intravenously, elevation of lower part of body, warmth and circulatory stimulants (vaso-constrictors).

Pre-Anesthetic Care of the Patient

1. Patients are usually brought to the operating division on a stretcher or in their own bed. They may be brought directly to the operating room or placed in a small ante room off the operating room known as the anesthetic room.

2. If the patient is conscious, and it will not harm him to do so, he may transfer himself from the stretcher to the operating table. The stretcher and the table are placed side by side and each is carefully held in that position while the patient moves. It usually takes two people - one to hold the stretcher against the table and the other one (on the opposite side) to see that the patient does not fall during the transfer.

3. If the patient cannot or should not move himself, sufficient help should be obtained to lift the patient and transfer him gently to the table. Again care should be taken that neither the stretcher nor the table will move, that an arm is not permitted to drop, or that the neck is not twisted or allowed to drop back. Serious results have occurred when these precautions have been neglected, especially if the patient is relaxed from the pre-anesthetic sedative or narcotic, or a basal anesthetic (avertin).

4. After the patient is placed on the table he should be made as comfortable as possible, whether asleep or awake. While he may not feel the discomfort if asleep, a strained position or uneven pad or unnecessary pressure may cause discomfort when the patient awakens. The position the patient is placed in before the anesthetic is started is known as the dorsal recumbent.

Previously a draw sheet folded on itself in such a manner to act as an arm restraint has been placed on the operating table under the patient's back. Two small pillows are placed as a head rest. A soft pad covered with rubber should be placed in the lumbar region of all patients being on their backs. The room is kept quiet and the patient disturbed as little as possible. Someone should remain with the patient constantly and this is the duty of the technician.

5. A patient who has had sufficient preliminary medication (or basal anesthetic) to make him drowsy may be restrained immediately with the arm restraint, and a knee restraint placed just above the knees. He is not responsible nor conscious of his actions, and this will prevent him falling off the table or his arms and lower extremities from dropping over the edge of the table.

6. If conscious, the patient may arrive in the operating or anesthetizing room nervous, frightened and even hysterical. The technician can comfort him and allay his fears greatly by a pleasant manner and an explanation of what is going to be done.

Care of the Patient at the Start of the Anesthetic (Induction)

1. The anesthetist will usually explain quietly what he or she is going to do, then places the mask over the patient's face. The technician then fastens the restraints - the knee strap being placed first, over the lower thighs just above the knees, the technician being certain that the strap will not interfere with the manipulation of the table. If a buckle is present, be sure that it does not press down on the patient anywhere and is not tight enough to interfere with the circulation. The knee strap will prevent the patient from injuring himself, if the excitement state of anesthesia is reached quickly and he struggles.

2. The arm restraints may be placed before the anesthetic is started or after the arms have relaxed from the effects of the anesthetic agent. This will depend upon the individual giving the anesthetic - his or her personal preference. The arms are placed between the folds of the restraint with the fingers straight and flat. The tips of the fingers are left exposed so that blueness (sign of poor circulation) can be watched for. An awkward position of the arms or too tight a restraint might interfere with the circulation and have serious results.

3. If leather wrist cuffs are used, they are slipped on the patient's wrist before the anesthetic is started and tightened later when the patient is relaxed. These hand ties or wrist cuffs are placed on the wrists in such a manner that they will not slip or tighten around the wrist. The technician remains in attendance at the head of the table to help in any way needed. The patient may require further restraint because of his violent struggle while going under the anesthetic.

4. If the patient is to receive spinal anesthesia, he is instructed to turn on his side with shoulders and buttocks flush with and perpendicular to the edge of the table. As soon as the spinal anesthetic is administered, the anesthetist extends the lower extremities and instructs the patient to turn on his back or abdomen (depending upon the weight of the drug used).

5. The avertin patient is instructed to turn on his left side for the introduction of the rectal tube, and after the administration of the avertin fluid, to turn on his back.

6. If the patient is to be put in a position other than the dorsal recumbent (after anesthetic is administered), all required equipment should be on hand before the anesthetic is begun, and as soon as the anesthetist gives consent, the patient is placed in the required position.

7. All of the above procedures should be performed as quietly and quickly as possible to avoid unnecessary delay which would prolong the time the patient is under the anesthetic.

Surgical Positions

The technician should be familiar with the various positions necessary to give the best access to the operative field. Any good position requires the following:

1. The parts or field to be operated must be prominent and accessible.
2. There should be no interference with the circulation to any part due to an awkward position or to constriction, nor undue pressure on any part of the patient.
3. There should be no interference with respiration as might occur from an awkward position, pressure of the arms on the chest, or from constriction of the gown about the neck.
4. There should be no pressure on any nerves. Improper position of the patient's arms has been the cause of serious paralyses.
5. The patient should be in as comfortable a position as possible, especially when conscious, and awkward strained positions should be avoided, even when the patient is asleep.

Care of the Patient After Anesthesia.

1. The artificial airways, nasal tube, intra thoracic tube and mouth airways, should be left in place until establishment of throat reflexes. Leaving them thus prevents the accumulation in the mouth and throat of mucous and vomitus to be aspirated (sucked) into the lungs. In avertin cases the jaw should be held up until the reflexes return sufficiently to prevent dropping back of the tongue, and airways should be left in place until the restoration of throat reflexes has taken place.
2. In transferring the patient from the operating table to bed or stretcher, great care should again be taken to prevent injury of the arms, legs or head, and any great strain on the area operated. The patient should be lifted on a full draw sheet extending from head to feet. The patient should be sufficiently covered with blankets to prevent chilling while being transported through the hospital corridors to his ward.

3. Unconscious patients should be placed in bed, on either side, with face to the mattress and the upper shoulder forward with both arms extended forward, lower leg flexed and back, upper leg extended and forward, until conscious, then the head of the bed should be slightly elevated.

4. Patients in a conscious condition following spinal or regional anesthesia are put into bed flat on their backs. If the spinal anesthetic is lighter than the spinal fluid, the foot of the bed is elevated for six (6) hours (from the time of injection). However, if the spinal anesthetic agent is heavier than the spinal fluid, the bed is kept level for at least four hours and then the head may be slightly elevated.

COMMON ANESTHETIC CONSIDERATIONS AND EMERGENCIES

The following outline will serve to emphasize some of the clinical states, signs or symptoms which may occur during the various phases of general anesthesia and which require attention by the anesthesiologist and the Technician.

-- not seen
** may occur

System Involved	Before Induction	During Induction	During Maintenance	During Emergency	After Recovery
A. Central Nervous System					
1. Excitement	**	**	--	**	**
2. Delirium	--	**	--	**	--
3. Convulsions	--	**	**	**	**
4. Coma (Unconsciousness) . . .	**	--	--	--	**
5. Psychoses	**	--	--	--	**
B. Cardiovascular System					
1. Vascular depression(fainting)	**	**	**	--	**
2. Circulatory collapse(shock)	**	--	**	**	**
3. Extreme sudden hypertension	--	**	**	**	--
4. Significant cardiac arrhythmias	**	**	**	**	--
5. Cardiac decompensation (heart failure)	--	--	**	--	**
6. Thrombosis-coronary,cerebral	--	**	**	--	**
7. Emboli(floating blood clots in circulatory system) . . .	--	**	**	--	**
C. Respiratory System					
1. Rapid Rate	--	**	**	--	--
2. Depression to apnea(absence)	--	--	**	**	**
3. Dyspnea	**	**	**	**	**
4. Cheyne-Stokes	--	--	**	**	**
5. Bronchiolar spasm	--	**	**	--	--
6. Hiccough	--	--	**	--	**
7. Pneumonia	--	--	--	--	**
8. Collapse of lung	--	--	--	--	**
D. Gastro-Intestinal Tract					
1. Nausea	**	**	--	--	**
2. Retching	**	**	--	**	**
3. Emesis	**	**	--	**	**
4. Diarrhea	--	**	--	--	--
5. Distention	--	--	--	**	**
E. Genito-Urinary Tract					
1. Oliguria(small amt. of urine)	**	--	**	**	**
2. Anuria (absence of urine) .	--	--	**	**	**
3. Polyuria(large amt. of urine)	**	**	--	--	--
4. Incontinence(inability to hold urine)	--	**	--	**	**
F. Miscellaneous					
1. Hypopyrexia(subnormal temperature)	--	--	**	**	**
2. Hyperpyrexia (fever)	--	--	**	**	**
3. Diaphoresis (sweating) . . .	--	--	**	**	**

GLOSSARY

Prefixes and Suffixes

A prefix is one or more letters placed or attached to the beginning of a word to modify its meaning. A suffix is one or more letters added to the end of a word to modify its meaning. A knowledge of the meanings of these additions will aid greatly in interpreting the expression or word used.

In designating the type of operation to be performed on an organ various suffixes are combined with the name of the organ. The common prefixes and suffixes of use to this course are given below, with their interpretation.

Prefixes

A - signifying without or not, as aseptic, meaning not septic, free from septic material.

Anti - signifying against or opposite; as anti-septic, meaning a substance used against septic matter.

Post - meaning after or behind; as post-operative, after operation.

Pre - signifying before; as preoperative, before operation.

Suffixes

Ectomy - from the Greek word meaning to cut out or remove; as cystectomy, removal of the bladder; gastrectomy, removal of the stomach. An operation ending in "ectomy" may be partial, meaning that part of the organ has been removed, or total, signifying that the whole organ has been excised.

Itis - Indicates inflammation of the parts or organ to which the termination is attached; as urethritis, inflammation of the urethra.

Lithiasis - from the Greek, meaning stone. Thus, nephrolithiasis means stones in the kidney.

Orrhaphy - from the Greek, meaning suture; used to designate repair of a part, as herniorrhaphy, repair of a hernia (rupture).

Ostomy - the formation of a permanent or semi-permanent opening, for drainage of a part. Ex: cystostomy, the formation of a more or less permanent opening into the bladder with the aid of a rubber tube or catheter.

Otomy - from the Greek word meaning to cut; and is used to indicate an incision into an organ, which is closed after the operation, thus, cystotomy is an incision into the bladder, such as is done to remove a bladder stone (cystolithiasis), and the wound is then sutured.

Pexy - from the Greek, meaning to fasten: thus nephropexy means to fasten the kidney, as is done in ptosis (low lying) of the kidney.

Plasty - to form; herniaplasty indicates a plastic operation on a hernia (rupture).

REFERENCES

The following references were drawn upon freely and are listed for the students' benefit:

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2. Care and Maintenance of Cystoscope - Catalogue of American Cystoscope Makers, Inc., New York City.
3. Eliason, Ferguson and Farrand - Surgical Nursing.
4. Homans - Textbook of Surgery.
5. Medical Department Soldier's Handbook - Chapter 3, Section 1.
6. Underwood - Textbook of Sterilization.

DEFENSE AGAINST CHEMICAL WARFARE

DEFENSE AGAINST CHEMICAL WARFARE

The object of training in defense against chemical warfare is to prepare the Army of the United States to resist with a minimum of casualties any attack that may be made against it by an enemy employing noxious gases or other chemical agents.

To deal with chemical warfare casualties, it is necessary to possess knowledge of the uses of chemical weapons and an accurate knowledge of the injuries which may be produced.

I. Limitation of Apparatus.

Present day protection against gas is not absolute, varies with the type of gas used and practical adaption of protective equipment. Protection is high in lung irritants to moderate in skin vesicants. Gas mask is 100% effective against lung irritants, whereas, gas mask and protective clothing are absolutely necessary for skin vesicants.

II. Gas Discipline and Training

Gas attacks will always cause some casualties, so the object of gas discipline is to reduce casualties to minimum. Chemical warfare depends for greatest success on surprise and employment against poorly trained troops.

III. Chemical Agents.

Includes those chemicals and chemical compounds, whether gases, liquids or solids, used in chemical warfare.

IV. Classification of Warfare Chemicals

- A. Physical State.
  1. Gases - Chlorine, Phosgene.
  2. Liquids - Mustard, Lewisite, Chlorpicrin.
  3. Solids - Diphenylchlorarsine, Diphenylaminechlorarsine, Chloracetophenone.
- B. Tactical Uses
  1. Direct Casualty Agents
     - a. Phosgene
     - b. Mustard
     - c. Chlorpicrin
     - d. Lewisite
  2. Harassing Agents
     - a. Diphenylchlorarsine (Sneeze Gas)
     - b. Chloracetophenone (Tear Gas)
  3. Screening Agents
     - a. Phosphorus
     - b. Smoke Mixtures
  4. Incendiary Agents
     - a. Phosphorus
     - b. Thermit
- C. Physiological Effects
  1. Lung Irritants

a. Phosgene
b. Chlorine
c. Chlorpicrin

2. Sternutators
a. Diphenylaminechlorarsine (Adamsite)
b. Diphenylchlorarsine (Sneeze Gas)

3. Lacrimators
a. Brombenzylcyanide
b. Chloracetophenone
c. Chloracetophenone Solution

4. Vesicants
a. Mustard
b. Lewisite

5. Nervous System Poisons
a. Hydrocyanic Acid

6. Asphyxiating or suffocating
a. Carbon Monoxide

7. Incendiaries (Refer to Chart)
a. Phosphorus
b. Thermit

D. Persistency
1. Persistent Chemical - one which will maintain an effective vapor concentration in the air at point of release for more than 10 minutes.
a. Mustard
b. Lewisite

2. Non-persistent Chemical - effectiveness less than 10 minutes.
a. Chlorine
b. Phosgene

V. Tactical Uses
A. Disable personnel, reduce its fighting efficiency, create panic, reduce morale.
B. Interdict area to occupation or passage of troops.
C. Damage or destroy materiel, contaminates food, roads, equipment, delays repairs.
D. Smoke to screen and blind.

VI. Method of Employment
A. Artillery
1. Shells - 75 mm. - 155 mm.

B. Airplane
1. Bombs
2. Sprays

C. Liquids and bombs placed in position.
D. Light mortar projectiles and projector bombs.
E. Gas candles and cylinders
F. Hand and rifle grenades.

VII. Protection Against Chemical Agents

A. Gas Mask

1. Individual protection against chemicals which attack the lungs and eyes, nose and throat; no protection against rest of body. Will not protect against CARBON MONIXIDE, AMMONIA GAS, so a special canister is necessary against these.

B. Protective Clothing

1. Covers body, gloves for hands and boots for feet, used by soldiers working in gassed area and handling gassed patients; can only be worn for limited periods.

C. Collective Protection

1. Gas-proof shelters, bomb shelters, room in cellar, or room in building; 20 square feet per person, with 9 foot ceiling, will allow one person to stay in room so constructed for 10 hours.
2. Alarm devices - whistles, sirens, bells, etc.
3. Chemicals for destroying chemical agents. (Decontamination)
   a. Earth - earth, sand, ashes, sawdust; layer 3 inches thick - doesn't destroy agent - forms a seal - more effective if wetted down by water.
   b. Water - effective against Lewisite, but reaction product, a non-volatile solid which is toxic and causes blisters on skin. Water is not effective against Mustard - too slow. If good drainage present, Mustard may be washed down.
   c. Chloride of Lime or bleaching powder mixed with water or earth, destroys vesicants. Vesicants containing arsenic produce poisonous product.
   d. Aeration and weathering - natural, decontamination, ordinarily are too slow.
   e. Incineration (burning) - practical method, but care must be taken to prevent vapor or smoke coming in contact with non-protected persons.
   f. Solvents - gasoline, kerosene, alcohol, carbon tetrachloride: used to remove excess vesicants - do not destroy chemical agents, but dissolve it so it is more easily removed.
4. Mobile bathing units.
5. Protective covers for materiel.
6. Protective ointments.
   a. To apply to exposed surface of body.
   b. To apply to shoes, clothing, etc.

VIII. Procedure during a gas attack.

A. When a gas attack is in progress.

1. Alarm given, mask adjusted, doors of gas shelter closed, fires put out, materiel protected.
2. Casualties removed and given first aid.

IX. Prevention of Gas Casualties.

A. Chemical agents are heavier than air, therefore, settle in shell holes, depressions in the earth, in dugouts, trenches; so most important measure to prevent casualties is to seek high ground and open spaces, free from gas.

In moving out of a gas cloud it is best to proceed cross wind. If gas cloud envelopes a dwelling, close all doors and windows tightly, put out fires, plug all chimneys and go to upper floor. (Third floor or above will be fairly safe).

Gas mask prevents gas effects on eyes, face and lungs and should be adjusted at first odor of gas and not removed until ordered.

If no gas mask available, improvise one - breathe through handkerchief saturated with a solution of baking soda, soap suds or urine; clean cloth or cotton will serve if no handkerchief is available, as all gases except carbon monoxide and ammonia gas are acid in reaction.

X. Six Basic Principles for Identification of Chemical Agents by Odor.

A. Do not inhale deeply. Only the nose can smell. Sniff.
B. Sniff only once. Repeated smelling dulls the senses of smell.
C. First smell, then think. The memory of odors can be trained by practice.
D. Every perception of odor must be named. Learn odors by memory of things smelled, rather than by the name of something else. A thing is odorless only when no perception of odor is obtained.
E. After each test, breathe out strongly through the nose seven times. Do not smell a new sample until the old perception of odor has vanished.

XI. Evacuation of Gas Casualties.

A. At Aid Stations.
   1. Examine mask and if gas abounds, retain it on patient. Remove equipment and loosen clothing. Remove clothing if it is contaminated with mustard gas, and wrap in clean blanket. If affected with mustard gas, wash eyes with soda bicarbonate solution (2%). Apply dressing to wounds.
   2. See that patient avoids unnecessary movements if suffering from a lung irritant. Keep him warm and quiet. Encourage vomiting by giving tepid salt water, if safe to remove mask.
   3. Inspect emergency medical tag and make proper notation thereon.
   4. Expedite evacuation to collecting station.

B. At Collecting Stations
   1. Change clothing and thoroughly bathe mustard cases if possible.
   2. Wash eyes of mustard cases.
   3. Completely demustardize whenever time and facilities permit.
   4. Adjust dressings.
   5. Give special treatments as indicated including administration of oxygen, and bleeding in lung cases.
   6. Prepare patient for evacuation.

C. At special degassing stations.
   1. Administer neutralizing chemicals and de-gas clothing by group method.

D. At hospital stations.
   1. Sort.
   2. Classify.
   3. Segregate.
   4. Bathe.
   5. Retain critical cases for observation.
   6. Demustardize if not previously and thoroughly done.
   7. Bleed and administer oxygen as indicated.
   8. When fit for transportation, evacuate to rear.

TYPE OF INCENDIARY	SIZE	COMPOSITION	METHOD OF EXTINGUISHING
Small "Electron" bombs.	I kilogram (2.2 pounds)	Cylinder of combustible magnesium alloy containing thermit mixture to ignite the magnesium alloy. May contain an explosive charge.	Spray (not a stream) of water. Cover with sand. Remove with long-handled shovel to a metal container with layer of sand in bottom.
Medium and large "Electron" bombs.	2-25 kilogram (4.5 to 55 pounds)	Same as above. All large incendiary bombs will contain some explosive.	Same general methods as above but experienced fire fighters are required to handle the largest bombs of this type.
Thermit	15 kilograms (33 pounds) 50 kilogram (132 pounds)	Non-inflammable case containing mixture of iron oxide and aluminum (thermit) ignited by a "first fire" charge that is ignited either by impact or fuse. May contain an explosive charge.	Burning thermit cannot be extinguished. Molten iron produced may be cooled to reduce spread of fire.
White phosphorus bombs.	30 pound (may be of any size)	White phosphorus with an explosive charge to ignite and scatter the phosphorus upon impact.	Water will extinguish burning phosphorus. Copper sulfate solution, if available, is even more effective. Remove all fragments to a safe place and burn. Avoid handling the fragments with bare hands.
Multiple Effect Bombs.	12 kilogram (26.5 pounds)	Separate incendiary units of phosphorus and magnesium alloy which scatter upon impact and ignition.	The burning magnesium units can be handled in the same manner as the electron bombs. Burning phosphorus can be extinguished with water and then should be removed to a safe place while wet.
Oil bombs.	Large drums.	Fuel oil or solidified gasoline. May contain other combustible substances. Scattered and ignited by a black powder burster charge upon impact.	Smother with sand.
"Incendiary leaves"	Approximately 4 x 4 inch squares.	Moist squares of cardboard or nitrocellulose coated with phosphorus which ignite as they become dry.	Immerse in water or copper sulfate solution. Burn in some safe place. Be sure that all are collected as one unrecovered square may cause a serious fire.

CHARACTERISTICS OF PRINCIPAL CHEMICAL AGENTS

Lung Irritants

Name and symbol	Phosgene (CG)	Chlorine (CL)	Chlorpicrin
Odor	Green corn, new cut hay	Pungent	Sweetish; fly paper
Color and state in field	First white, then changing to colorless gas.	Greenish yellow gas	Oily liquid changing slowly in open to colorless gas.
Effects on body	Choking, coughing, hurried breathing, pains in chest due to injury of lower lungs. A few breaths in average field concentration produce a casualty. Effects progress slowly.	Coughing, smarting of eyes, discomfort in chest followed by nausea and vomiting. A 2-minute exposure to average concentration produces a casualty.	Watering and irritation of eyes, coughing, nausea, vomiting lung irritation. Approximately 1/4 as toxic as phosgene.
Persistency in open ground	5 to 10 minutes in summer; about 20 minutes in winter	About 5 minutes	2 hours in summer; about 12 hours in winter.
Action on food	Contaminates. In some cases poison removed by heating and ventilation but taste remains bad.	About the same as phosgene.	About the same as phosgene.
Action on metal	Metal dry, none; if wet, vigorous corrosion	Same as for phosgene.	Slight tarnish.
How used	For casualty effect. In cylinders, projectors, medium artillery mortars, or aviation bombs	For casualty effect. In cylinders or projectors as substitute for phosgene or mixed with phosgene.	For harassing and casualty effect. In shell, bombs or spray, as substitute for or mixed with other agents.
Protection needed	Gas mask	Gas mask	Gas mask
First aid treatment	Remove victim from gassed atmosphere; place at absolute rest lying down; do not allow to walk; keep warm with blankets, hot water bottle; give hot coffee or tea - no alcoholic stimulants; oxygen required in severe cases; evacuate. Artificial respiration is not to be performed on lung irritant gas casualties.		

CHARACTERISTICS OF PRINCIPAL CHEMICAL AGENTS

Vesicants

Name and symbol	Mustard Gas (HS)	Lewisite (MI)
Odor	Garlic or horseradish	Geraniums, then biting
Color and state in field	Dark brown liquid, changing slowly to colorless gas	Dark Brown liquid, changing slowly to colorless gas.
Effects on body	Blisters skin. Symptoms delayed 2 to 4 hours. If exposed, eyes burn and inflame. Skin in contact with gas or liquid, discolors, followed by blisters and sores. If breathed, hoarse cough develops pains in chest, general inflammation of lungs.	Skin shows slight irritation in 15 minutes followed by grayish discoloration and blisters in 30 minutes to 1 hour, systemic poisoning, vomiting. If breathed powerful lung irritant, effects develop in 1/2 hour. If unprotected, eyes are irritated immediately.
Persistency in open ground	Summer; 3 to 4 days Winter; several weeks	Summer; 24 hours Winter; several weeks
Action on food	Renders unfit for use	Poisons; food cannot be purified
Action on metal	Very slight	Very slight
How used	For casualty effect or to deny ground. In artillery or mortar shell, airplane bombs or spray, and other land mines.	Same as mustard gas
Protection needed	Gas mask and protective clothing	Gas mask and protective clothing.
First aid treatment	Remove from gassed area; remove contaminated clothing. If only portions of clothes splashed by liquid, cut these away. If face exposed to gas, wash eyes and rinse nose and throat with saturated boric acid, weak baking soda or common salt solution. If gas breathed, treat as lung irritant casualty. First aid must be prompt. Vapor burns lessened or prevented by immediate hot bath; cleansing with kerosene or gasoline before using soap desirable.	First aid must be almost immediate. Treatment similar to that for mustard. Greatest danger is absorption of arsenic. First apply 5% solution aqueous sodium hydroxide (caustic soda) Following this, or if sodium hydroxide not available, cleanse vapor burns with soap and water, cover thickly with ferric hydrate paste and gauze. In case of liquid burn after applying sodium

CHARACTERISTICS OF PRINCIPAL CHEMICAL AGENTS (Continued)

Vesicants Con't		
Name and Symbol	Mustard Gas (HS) Areas wet with liquid mustard should be immideeately and repeatedly swabbed with kerosene gasoline, any oil, alcohol, carbontetrachloride (pyrene), or weak solution chloride of lime and water, using fresh cloth each time. After this use hot water and soap. All cloths used should be burned. Evacuate all casualties.	Lewisite (MI) Hydroxide swab with oil as for mustard then dress with paste as above. Evacuate all casualties.

Irritants

Name and symbol	Adamsite (DM)	Chloracetophenone (CN)	Tear Gas Solution (CNS)
Odor	Not definite; slightly like coal smoke	Like apple blossoms	Like fly paper
Color and state in field	Yellow smoke cloud; becomes invisible before chemical is dissipated	Bluish gray smoke from burning powder	Colorless liquid, changing to colorless gas.
Effects on body	Immediate sneezing, followed by headache, nausea, vomiting, temporary physical debility.	Piercing irritation of eyes to produce tears	Piercing irritation of eyes, tears, followed by nausea, vomiting.
Persistency in open ground	About 5 minutes	About 5 minutes	Summer: 1 hour Winter: 6 hours
Action on food	Poisons	Gives disagreeable odor	Contaminates. In some cases food made potable by heating and ventilation.
Action on metal	Tarnishes slightly	Tarnishes steel slightly	Tarnishes steel slightly.
How used	For harassing. In candles.	For harassing. In grenades.	For harassing. In artillery and mortar shell; airplane bombs or spray.
Protection needed	Gas mask with good filter	Gas mask with good filter	Gas mask.
First aid treatment	Place at rest, loosen clothing; bathe nose and throat with salt water or baking soda solution, and exposed body surface with soap and water; keep away from heat. Breathing from bottle containing chloride of lime is helpful; do not evacuate mild cases.	Have men leave gassed area and face wind; if this is not sufficient, bathe eyes with weak solution of boric acid or bicarbonate of soda (baking soda), do not rub eyes. Do not evacuate.	

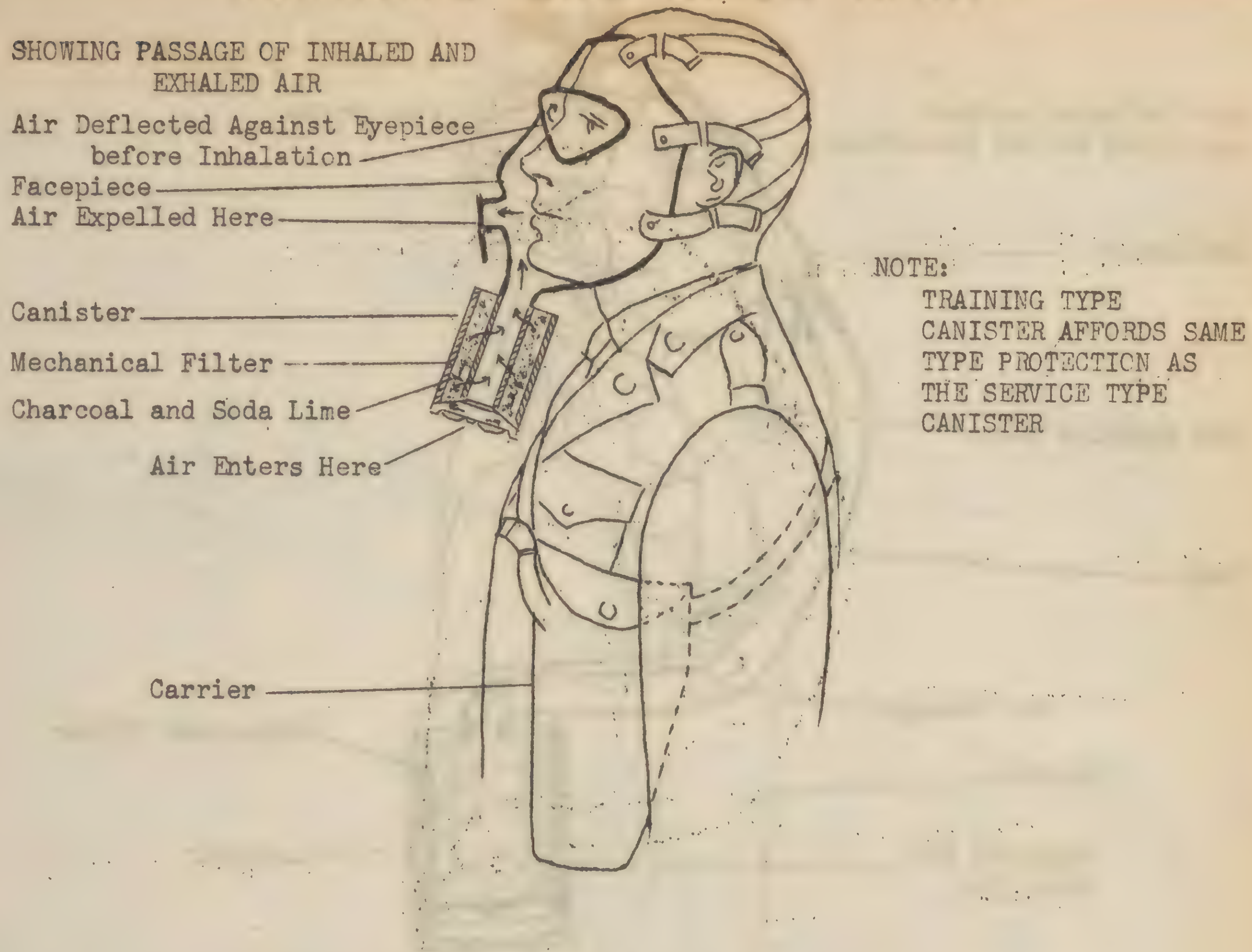
Screening Smokes

Name and symbol	White Phosphorus (WP)	HC Mixture (MC)	Sulfur Trioxide Solution (FS)
Odor	Phosphorus matches	Acrid, suffocating	Acrid or Acid
Color and state in field	Solid which changes to flame and white smoke on contact with air.	Solid, producing white smoke in burning.	Liquid changing to white smoke on contact with air.
Effects on body	Smoke, none; particles produce severe heat burns which heal very slowly	None	Smoke, mild prickling of skin, non-injurious.
Persistency in open ground	Smoke drifts with wind; solid particles give off smoke until consumed, about 1 or 2 minutes after shell bursts.	Drifts with wind. Smoke remains at point of release during burning time of munition.	Drifts with wind. Persists only while container is discharging.
Action on food	Smoke gives disagreeable odor.	Gives disagreeable odor.	Liquid rendered unfit to use; smoke gives disagreeable odor
Action on metal	None	None, if dry	Vigorous corrosion in presence of moisture. Liquid droplets damage paint work.
How used	For screening, incendiary or casualty effect. In artillery & mortar shell, airplane bombs	In smoke pots, candles or grenades.	Screening. In airplane spray. Used in artillery and mortar shell and cylinders for simulation of gas in training
Protection needed	For smoke, none, for burning particles none provided	None	Generally none.
First aid treatment	Stop burning by immersion of affected part in water, or use wet cloths or mud; then pick out phosphorus particles and treat	None required	None required unless splashes with liquid. Men handling substances should wear masks and gloves. If clothing splashes, remove same. Liquid on body should

Screening Smokes (Con't)

Name and symbol	White Phosphorus (WP)	HC Mixture (HC)	Sulphur Trioxide Solution (FS)
	As ordinary heat burns. If copper sulfate solution available, its application will stop burning by coating the particles with copper so they can be picked out of flesh. Evacuate severe cases.		off with dry cloth, then water applied. When smoke is laid by airplanes in training, personnel and equipment should be at least 300 yards away from line of flight.

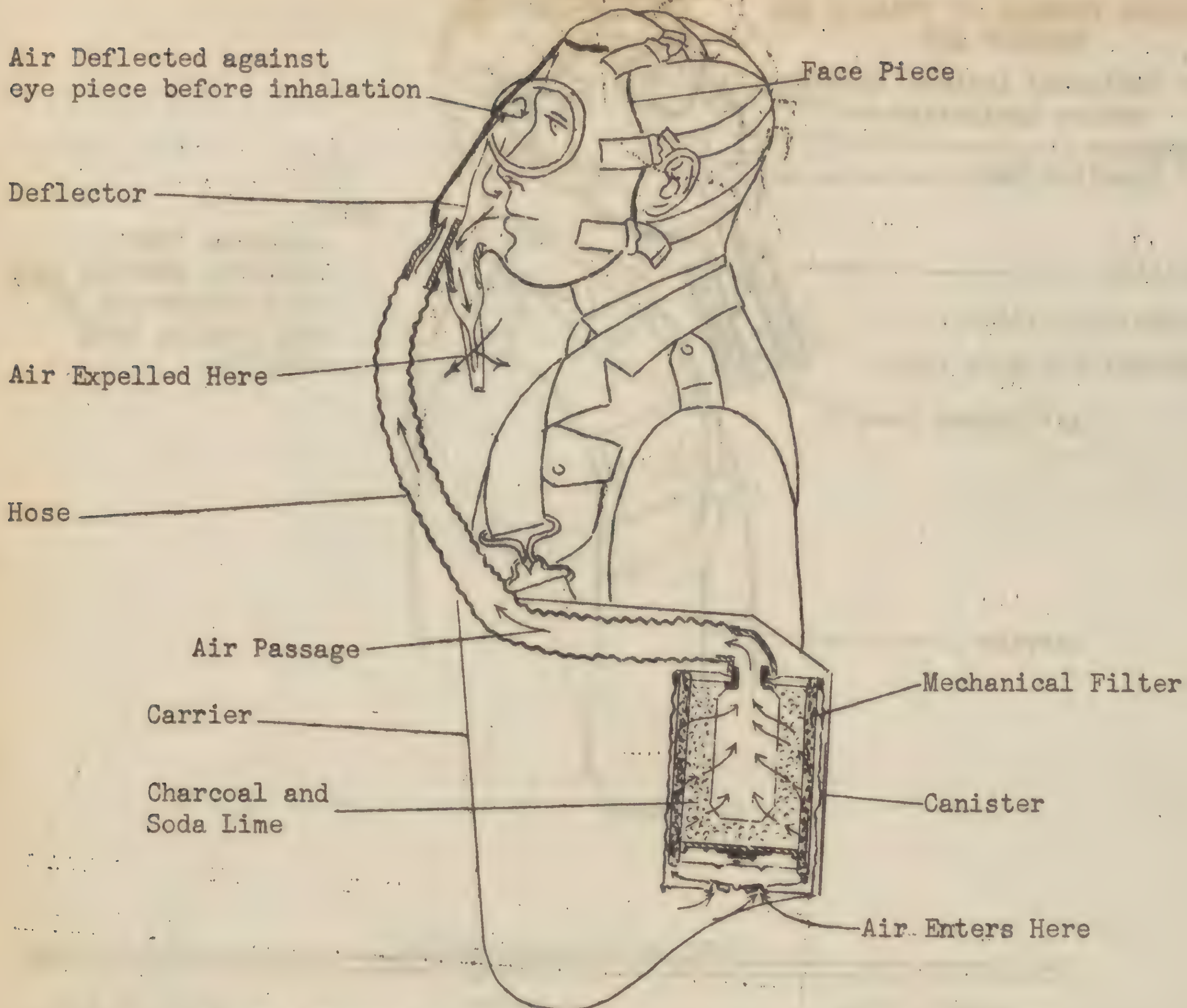
TRAINING GAS MASK M1A1

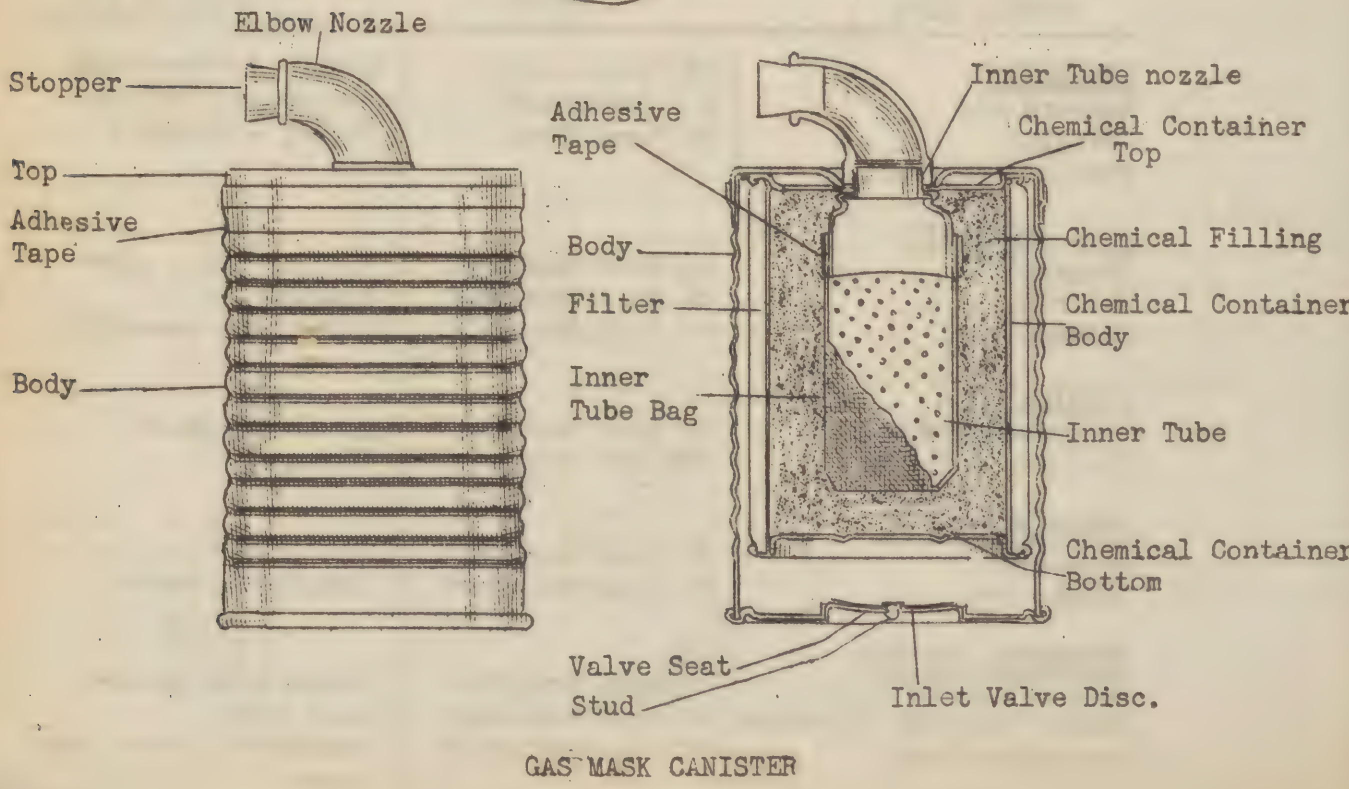


CHEMICAL WARFARE AGENTS

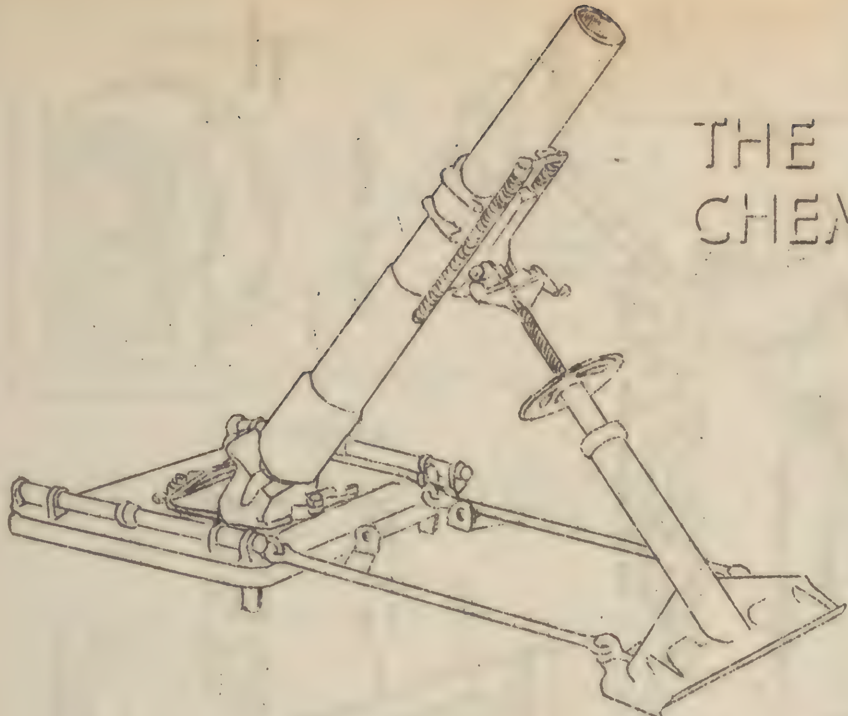
COMMON NAME	C W SYMBOL	ODOR IN AIR
VESICANTS:	HS Persistent	Garlic - Horseradish
Mustard Gas	M-1 Persistent	Geraniums - Biting
Lewisite	ED Persistent	Biting - Stinging
Ethyldichlorarsin		
LUNG IRRITANTS:		
Phosgene	CG Non-Persistent	New cut hay - corn
Chlorine	CL Non-Persistent	Pungent
Chlorpicrin	PS Persistent	Flypaper - sweetish
LACRIMATORS:		
Chloracetophenone	CN Non-Persistent	Locust blossoms
Tear Gas Solution	CNS Non-Persistent	Flypaper
IRRITANT SMOKES:		
Adamsite	DM Non-Persistent	Coal smoke
Sneeze Gas	DA Non-Persistent	Indefinite odor
SCREENING SMOKES:		
White Phosphorus	WP Non-Persistent	Phosphorus matches
Sulfur Trioxide Solution	FS Non-Persistent	Acid odor
Hexachlorethane	HC Non-Persistent	Suffocating when very dense

SERVICE GAS MASK





GAS MASK CANISTER

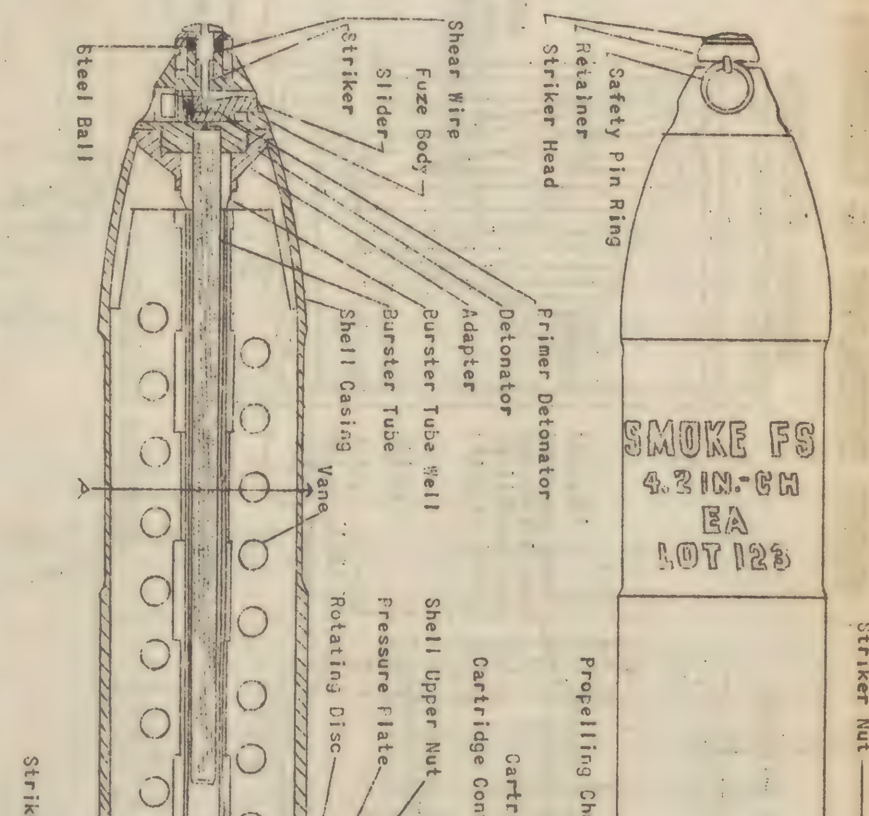


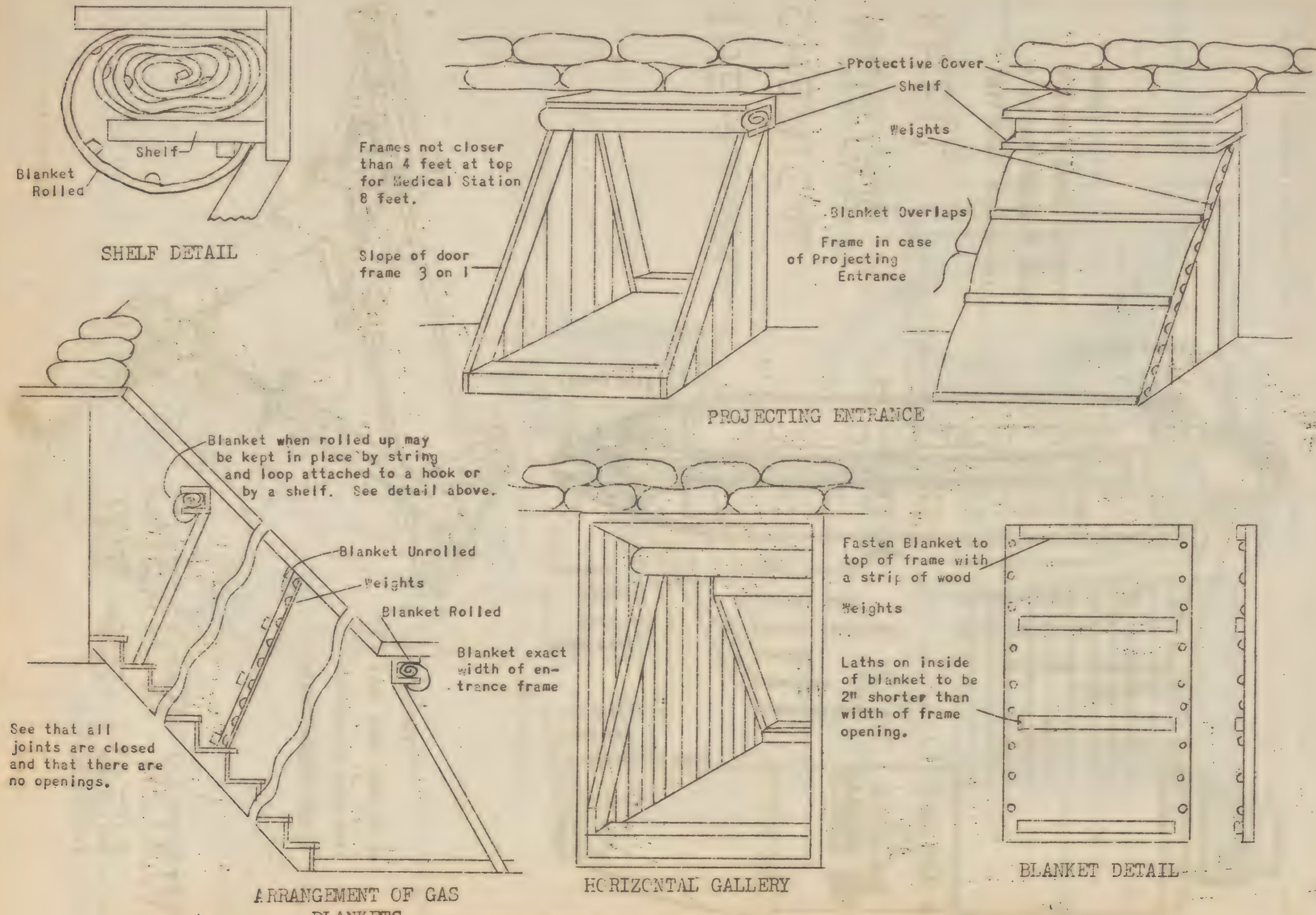
THE 4.2 INCH CHEMICAL MORTAR

RIFLED, MUZZLE LOADING DESIGNED FOR HIGH ANGLE FIRE, RANGE FROM 600 to 2,400 YDS.

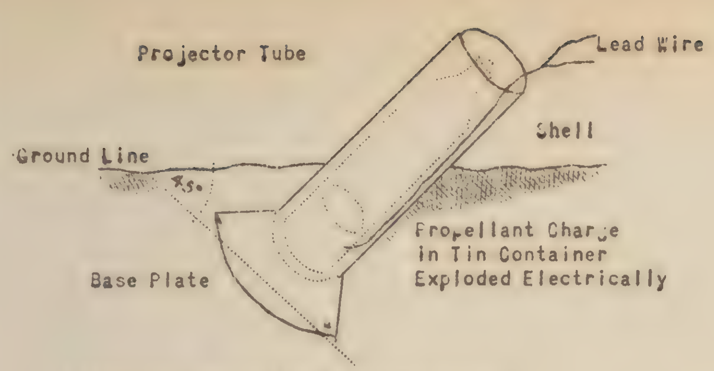
THE 4.2 IN. CHEMICAL MORTAR SHELL

SHELL WEIGHS APPROXIMATELY 25 POUNDS; CARRIES AN AVERAGE OF ABOUT 6 POUNDS OF CHEMICAL AGENT

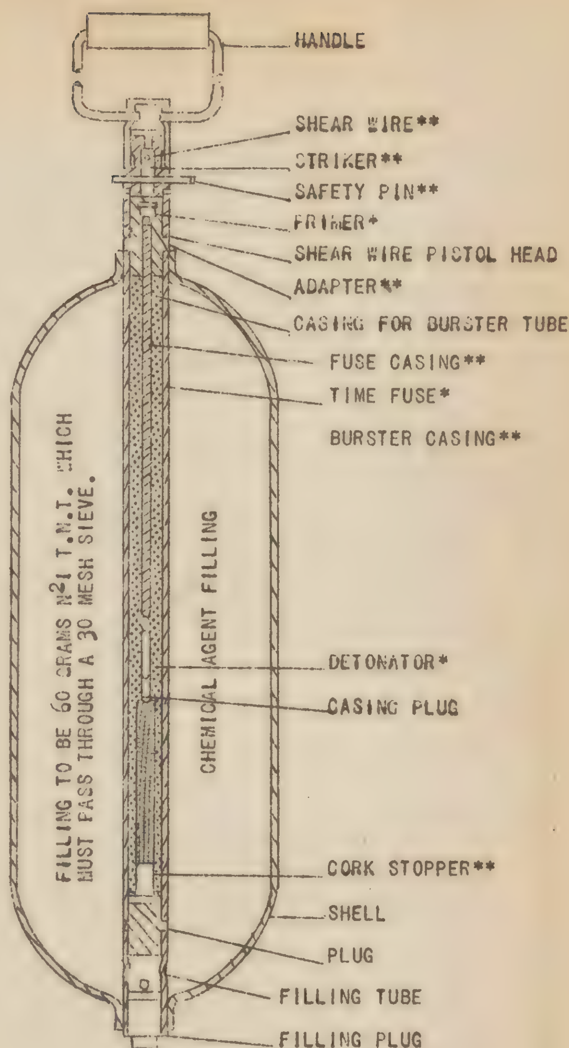




<u>TYPICAL ARRANGEMENT FOR GAS-PROOFING DUGOUTS</u>



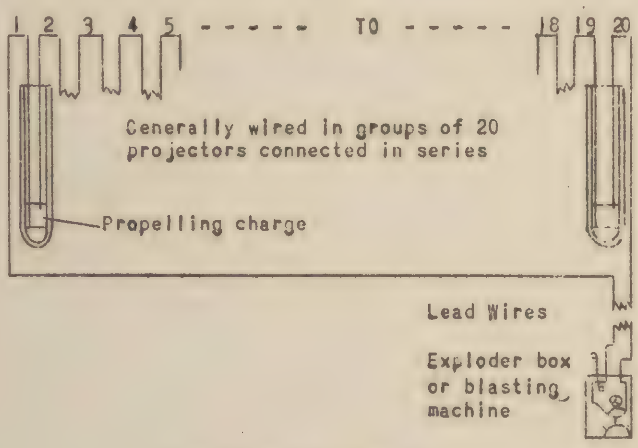
Livens Projector (Semi-Surface Set Up)



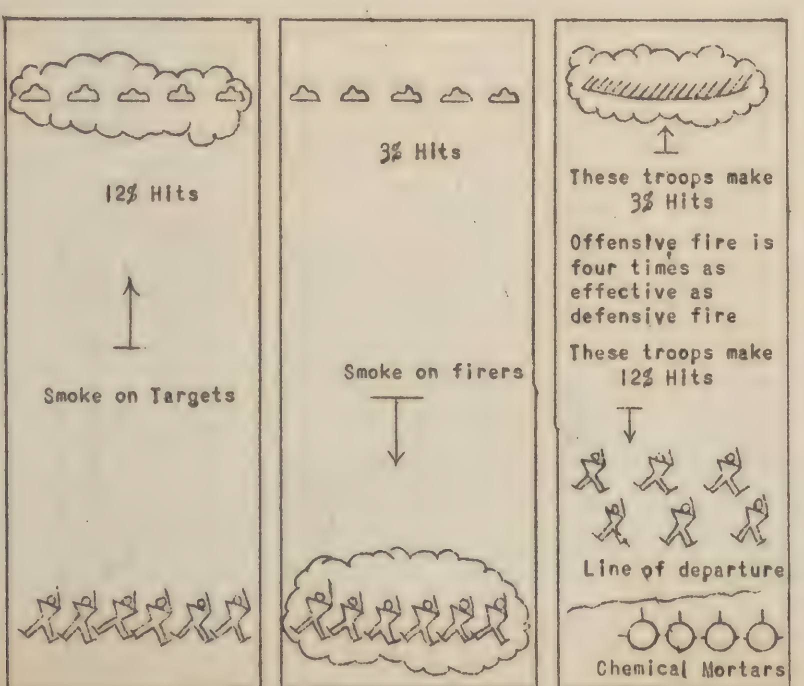
*FUZE MI CONSISTS OF PRIMER, TIME FUSE AND DETONATOR
**BURSTER TUBE MI

LIVENS PROJECTOR

This is a weapon of limited range and mobility but of high efficiency. Its range is 1,450 yards. The range is controlled by the propelling charge used. It is installed and fired with an elevation of 45°.



METHOD OF WIRING PROJECTORS



TO HIT A TARGET WITH A RIFLE ONE MUST NOT ONLY SEE IT BUT ACCURATELY AIM AT IT. FOG, HAZE AND EARLY DAWN HAVE LONG BEEN USED FOR CONCEALMENT, SURPRISE AND TO REDUCE CASUALTIES IN AN ATTACK. SMOKE GIVES THE SAME EFFECT AS FOG BUT CAN BE CONTROLLED AS TO TIME AND PLACE. SMOKE IS USUALLY FIRED BY ARTILLERY OR CHEMICAL TROOPS. WHITE PHOSPHOROUS (WP) PRODUCES THE BEST SMOKE AND IN ADDITION WILL CAUSE GRASS AND WOODS FIRES AND IF A PIECE OF THE BURNING PARTICLE STRIKES THE BODY, IT WILL CAUSE A SEVERE BURN.

TREATMENT OF CHEMICAL WARFARE CASUALTIES

TREATMENT OF CHEMICAL WARFARE CASUALTIES

Ancient Chinese armies tried to repel the mounted hordes of Ghengis Khan with pots containing substances that gave off a nauseating odor. Ancient Greeks repelled the Persians by pouring "Greek Fire", which was burning sulphur, down upon their heads, from the ramparts of fortified cities.

Chemical warfare is quite old. The first attack in modern times was delivered by the Germans against the British at Ypres in 1916. They used Chlorine. The attack was a complete surprise and many casualties resulted. Other gas attacks, made by the Germans, later, never quite reached the same degree of success as the first one, as the element of surprise was lost and gas masks and other protective measures were developed to combat such an attack.

Chemical warfare is often called "gas warfare", because the first chemical used in modern warfare was the gas Chlorine. Since then other chemicals have come into common use in war and many of them are liquids and solids. The term "gas warfare" is, therefore, no longer accurate.

CLASSIFICATION OF CHEMICAL AGENTS

Physiological Classification

Chemical agents used in warfare may be classified according to the kind of damage they produce in the human body. This is called a physiological classification.

1. Lung irritants. Example: Phosgene -- CG
   These agents, when breathed, cause damage to the lungs.
2. Vesicants (or blistering agents). Example: Mustard Gas -- HS
   These, either in liquid or vapor form, upon contact with the body, produce large watery blisters which are slow to heal.
3. Lacrimators (tear producers). Example: Chloracetophenone -- CN
   Exposure to these agents causes an intense temporary irritation of the eyes and a copious flow of tears.
4. Irritant smokes (sternutators). Example: Adamsite -- DM
   These agents when breathed in smoke clouds cause sneezing, intense irritation of the nose, headache, nervous depression and a desire to vomit. These effects are temporary.
5. Incendiaries. Example: Thermite -- Th
   These agents are used to start fires, but, if any of them come in contact with the skin, they cause burns.
6. Screening smokes. Example: Sulphur Trioxide -- FS
   Screening smokes are used to hide troop movements and to obscure enemy observation. They produce no harmful effects on the body.

Persistence

Chemical agents can also be classified according to the length of time they remain dangerous.

1. Persistent chemical agents are those that remain in the vicinity for some time, longer than 10 minutes. Example: Mustard, HS
2. Non persistent chemical agents are those which are destroyed or blown away by the wind in a short time, less than 10 minutes. Example: Chloracetophenone -- CN or tear gas.

"Persistent" and "nonpersistent" are relative terms, that is, some of the agents we call "nonpersistent" are more persistent than some other nonpersistent agents.

Example: Phosgene -- CG -- nonpersistent, lasts about 10 minutes
Chlorine -- Cl -- nonpersistent, lasts less than 10 minutes

Generally speaking, the gases are less persistent than liquids or solids.

Classification According to Military Use

1. Casualty agents.
   These are intended to make hospital cases out of soldiers.
   Example: Phosgene -- CG
2. Harassing agents.
   These cause only temporary discomfort, such as sneezing, coughing or crying.
   Example: Chloracetophenone -- CN -- or tear gas.
3. Screening smokes.
   These cause no more discomfort than ordinary smoke, and are used only to hide movements from the enemy.
   Example: Sulphur Trioxide -- FS
4. Incendiaries.
   These are intended to produce fires in supply dumps or anywhere that a suitable amount of combustible material is collected. They are not dangerous to humans, but will produce large and damaging fires unless someone is present who knows how to put them out.
   Example: Thermite -- Th

It is important for the student to become familiar with the characteristics of the various chemical agents listed in the accompanying table. First, because some, the casualty agents, are the only ones that are very dangerous. Second, because damage done to the soldier by chemical agents can be prevented entirely, or at least minimized, by prompt and appropriate emergency treatment. This treatment differs according to the kind of chemical agent encountered. Fortunately, emergency treatment for all of the chemical agents used in warfare is simple, can be understood and applied by any intelligent person, and effective remedies are usually within easy reach of any soldier. Chemical attacks generally depend for success on the element of surprise more than any other weapon. Against well trained, well informed troops, even the casualty agents, such as Phosgene and Mustard, have little more than nuisance value.

A chemical attack can be detected by:

1. Characteristic odor of the chemical.
2. If the attack is made by artillery or mortar fire, there will be a large number of shells which explode without the loud, sharp crack of high explosive. Instead there will be a number of weak, dull, and, apparently, useless bursts. This is because only a small bursting charge is used in chemical shells, in order not to spread the chemical too widely and thinly over

the area to be gassed.

3. High explosive shells produce black smoke on bursting. Gas shells produce thin white smoke.

A well trained soldier becomes suspicious of a gas attack when he hears a weak explosion of a shell. He listens for more, because no gas attack can be made with only one shell. If he hears no more, the weak explosion was, probably, from a high explosive or shrapnel shell that failed to explode properly. Such shells are called "duds" and are fairly common. If many such "duds" land in his vicinity, it is a gas attack, and he sniffs to get just enough to detect the characteristic odor, in order to identify the gas. He then puts on his gas mask, gives the alarm, and, if his duties permit, moves out of the danger area. Panic and hasty decisions help the enemy, especially if harmless smokes are considered to be poisonous gases, or, as has happened, if the acrid, eye-irritating smoke from our own guns produces a belief that a gas attack is in progress.

Methods Used to Deliver a Chemical Attack

1. Artillery Fire.
   Any shell that can be fired from a gun may be filled with gas. Shells from 75 mm. guns have a range of about 11,500 yards. There is so little room in the shell for the gas that this gun is not effective if used for lung irritants or other nonpersistent chemicals. For vesicants, like Mustard and Lewisite, it is useful. The 155 mm. howitzer can be used for nonpersistent chemical agents, as well as for Mustard and Lewisite. It has a range of about 10,500 yards. Artillery fire has the advantage that it can make a gas attack at long range, which lessens the danger of large clouds of gas blowing back on the attacker. Artillery fire is also very accurate.
2. Mortars. 81 mm. Range up to 2470 yards.
3. Mortar, chemical. 4.2 inches. Range up to 2400 yards.
4. Livens projectors. Range up to 1450 yards
   These projectors are like sections of large pipe and are always fired 20 or 25 of them at a time by placing them in a trench in the ground at the proper angle. Firing is done by electricity. All 25 are always fired at once and thereafter no more firing can be done from the same point, as the loud noise and cloud of smoke gives away their position, which will probably soon be bombarded by the enemy with high explosive. In spite of this handicap, the Livens Projector has one great advantage, a very large concentration of gas can be suddenly delivered to one place at one time.
5. Cylinders.
   These are large metal containers, similar to those used for commercial oxygen. A number of cylinders are placed so that the gas will be borne away on the wind towards the enemy. Valves are then opened and the gas allowed to escape. Operators of cylinders must always wear gas masks. The cloud of gas liberated from the cylinders floats off on the wind toward enemy troops, gradually spreading and widening on the way. It is effective up to 7,500 yards. Beyond this range it becomes too thin to be of military value. Only true gases can be liberated from cylinders. Liquids like Mustard (HS) and Lewisite (M-1) obviously will not be borne away by the wind.

6. Land Mines.
   Chemicals can also be used in land mines, which are metal containers of chemical, arranged so that they will be detonated when stepped on.
7. Airplanes.
   Any chemical agent may be sprayed from a tank on an airplane. It is more likely that the heavy liquid chemicals will be distributed by this means. The light gases are apt to dissipate and become ineffective before they reach the ground.

Lung irritant chemicals are used tactically to cause casualties among and to reduce the efficiency of enemy troops. If their use is accompanied by great surprise their effectiveness is greatly increased, by causing panic. Panic is not likely to occur among soldiers who understand how the various gases work and what measures to take to render them ineffective. The vesicant or blistering gases are used to cover ground, trees and buildings, so as to make it dangerous for the enemy to use them. The vesicants, Mustard (HS) and Lewisite (M-1) are very persistent, more so in cold than in warm weather. Vesicants are not likely to be used by an attacking army (except by small units to protect their flanks) since if they advance they must go through the ground that they have made dangerous. Vesicants are likely to be used by a retreating army or to slow up the progress of the enemy.

The time to expect a nonpersistent chemical attack is at dawn, during rainy or foggy weather with very little wind. Winds above ten miles per hour rapidly dissipate a gas cloud. Bright sunshine increases the rate of decomposition of most warfare chemicals.

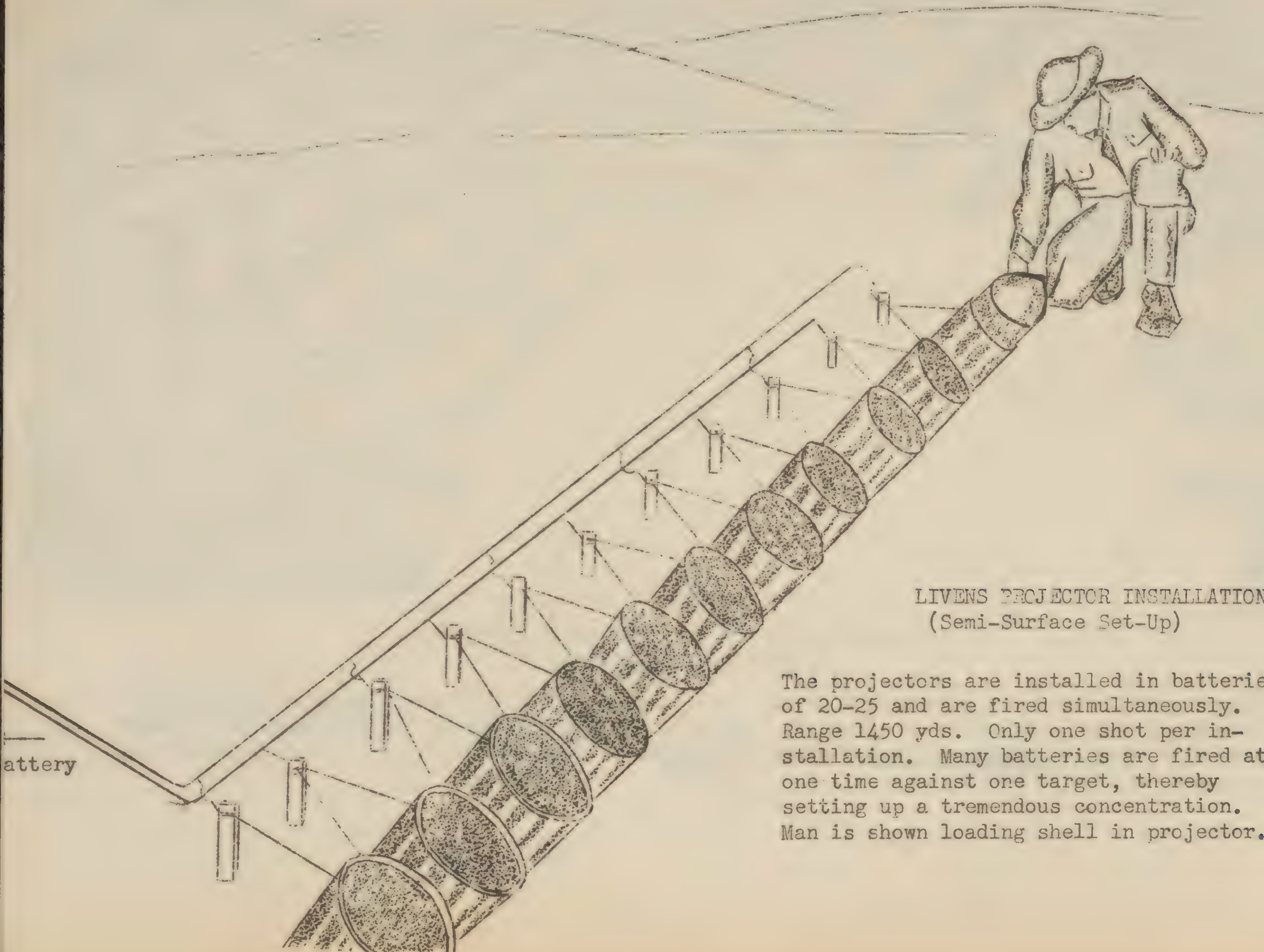
Persistent agents, like Mustard (HS) and Lewisite (M-1) are more apt to be laid down on ground not yet occupied by troops, with the hope of keeping the presence of the gas a secret until the enemy choose the contaminated ground to make a counter attack. Discovery that ground has been contaminated with either of these agents will permit the use of Chloride of Lime or other measures to render the ground safe for the passage of troops.

Six Basic Principles for the Identification of Chemical Agents by Odor

1. Do not inhale deeply. Sniff.
2. Sniff only once. Repeated sniffing dulls the sense of smell.
3. First sniff, then think. The memory of odors can be trained by practice.
4. Every perception of odor must be named. Learn odors by memory of the thing sniffed, rather than by the name of something else. A thing is odorless only when no perception of odor is obtained.
5. After each test, breath out strongly through the nostrils several times. Do not sniff a new sample until the old perception of odor has vanished.
6. Do not smoke while sniffing. Smoke dulls the sense of smell.

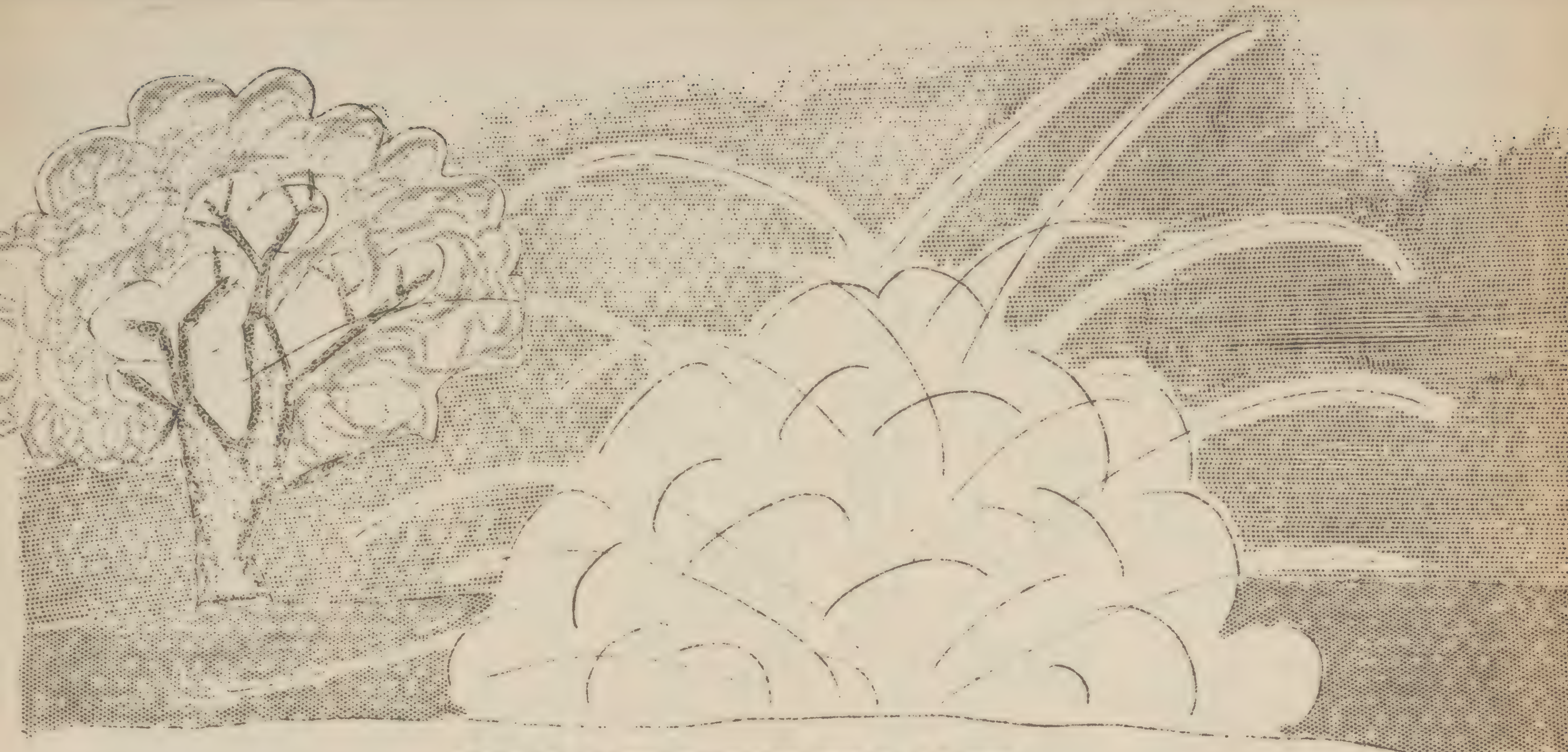
The 4.2 inch CHEMICAL MORTAR

This mortar has great rapidity of fire (20-25 rds. per minute). The shell has a large capacity (about 8 lbs.). Therefore, it is ideal for firing smoke and for putting down and maintaining heavy concentrations of chemical agents. Maximum range is 2400 yards. The mortar can be installed in about 5 minutes.



LIVENS PROJECTOR INSTALLATION
(Semi-Surface Set-Up)

The projectors are installed in batteries of 20-25 and are fired simultaneously. Range 1450 yds. Only one shot per installation. Many batteries are fired at one time against one target, thereby setting up a tremendous concentration. Man is shown loading shell in projector.



BURST OF A WHITE PHOSPHORUS FILLED 4.2-INCH
CHEMICAL MORTAR SHELL

One shell will screen a front of 50-100 yards. Note pieces of burning phosphorus flying in all directions. These pieces cause severe burns on striking the body. The smoke is nontoxic. Smoke is used to cover the advance of our infantry, to blanket enemy machine guns, and blind enemy artillery observation.

SYMPTOMS AND TREATMENT OF LUNG IRRITANT CASUALTIES

The Lung Irritants.

1. Chlorine -- Cl. Smells like Athlete's Foot preventive.
2. Phosgene -- CG. Smells like corn silk.
3. Chloropicrin -- PS. Smells like flypaper.

On explosure to Chlorine, soldier begins to cough and choke. The eyes smart and there is discomfort in the chest. Phosgene produces similar initial symptoms, except that the pain in the chest is more severe. Chloropicrin is similar to Chlorine and Phosgene in its effects, except that vomiting also is likely.

Chlorine is only 1/9th as poisonous as Phosgene. Chloropicrin is 1/2 as poisonous as Phosgene. Exposure to Phosgene in a concentration of one part Phosgene to 200,000 parts of air will kill in 1 hour. However, in this concentration it is easily detected by its sweet corn odor, so that ample time remains in which to take protective measures. Exposure to 1 part in 5,000 will cause death in a few minutes.

Exposure to Chlorine, 1 part in 200,000, will require 9 hours to produce death and exposure to Chloropicrin (PS),1 part in 200,000, will require 2 hours to produce death.

After exposure to either of these lung irritants, the initial symptoms of coughing and choking appear quickly, but quickly disappear if the soldier gets out of the gassed area or applies his mask. Since all 3 of these gases are heavier than air, they tend to sink to the bottom of trenches, dugouts and cellars, while neighboring high spots, such as the upper floors of buildings, may be almost free of gas. This is especially so in damp, foggy weather.

Following removal to a safe place, the gassed soldier, for a variable length of time, may remain relatively comfortable and free from symptoms. The soldier is symptom-free during this period because the damage done by the irritant chemical has not yet produced its full effect. In the case of Phosgene, this symptom-free period varies from 2 to 4 hours.

After 2 to 4 hours, signs of pulmonary edema occur. These are: shortness of breath, anxiety, pain at the lower end of the breast bone, and, in severe cases, rapid pulse, subnormal temperature and blueness of the finger nails and lips.

Pulmonary edema is the only effect of these lung irritants that will produce death. It is important, therefore, to understand the nature of pulmonary edema, in order to save the lives of its victims. Pulmonary edema from lung irritants is always temporary, gradually gets worse for about 72 hours, and then, regardless of what treatment the patient has received, if he is still alive, it subsides. Pulmonary edema is sometimes called "water on the lungs." Patients afflicted with it are said to be "drowning in their own fluid."

An understanding of the anatomy of the respiratory system will assist in understanding pulmonary edema.

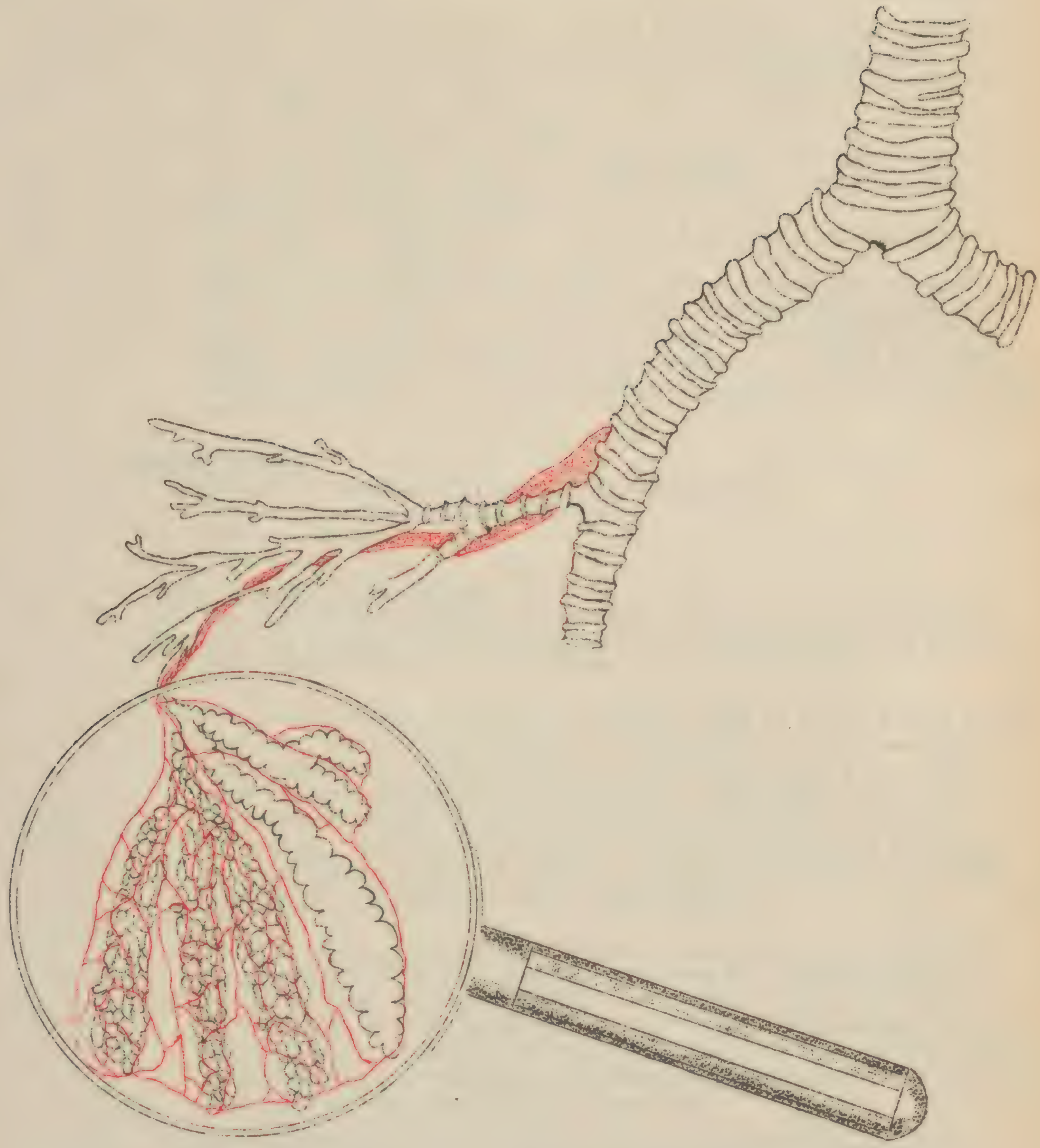
The windpipe, located in the neck, receives the air which gets into the throat from the nose. The windpipe goes down into the chest, where it divides into 2 parts, 1 for each lung. Each of these branches divides and subdivides until it resembles the roots of a tree. The finest or end divisions are so small that they cannot be seen, without the aid of a microscope. These finest roots of the bronchial tree, which is what this root of the windpipe is called, end in tiny bulbs, with walls so thin that oxygen in the air within this bulb leaks through the wall. On the other side of the wall is a blood vessel, whose wall is equally thin and the oxygen leaks through it and gets into the blood. At the same time carbon dioxide, which the body produces continually and wants to get rid of, leaks out of the thin wall of the blood vessel and through the thin wall of the bulb into the roots of the bronchial tree. This constant exchange of gases is the essential feature of respiration.

When pulmonary edema occurs from a lung irritant, swelling occurs in the thin wall of these bulbs, which are also called air sacs, and, at the same time, fluid leaks into the air sacs from the blood vessels on the other side. This is the common and universal reaction of any part of the body to irritation. First: redness, then swelling, then water secretion. It is the same process by which a blister forms on a burn, or on the hands if you use them too much for some unaccustomed work. In fact the air sacs of the lungs become blistered. This is pulmonary edema and, like the blisters on your hands, will disappear in time, but the accumulation of swelling and fluid crowds out the air in the air sacs. This is the serious effect of pulmonary edema. Without air we will all die in a few minutes. Fortunately, nature has provided a protection against a quick death from pulmonary edema by giving us much more lung than we need, so that we seldom use all our lung air sacs at once. In fact it is very difficult for anyone to take such a deep breath as to inflate all his air sacs at one time with air. Because of this most gassed soldiers still have enough air sacs in reserve with which they can breath while those that have been damaged can recover.

The principle of treatment of lung irritant is based on this point. We need only to keep the soldier alive, breathing with his undamaged air sacs, for 72 hours, after which the rest of his lungs will begin to recover.

Based on this knowledge of the damage caused by lung irritants, the following treatment can be outlined:

1. Remove soldier from the gassed area to a safe place, preferably to the battalion aid station.
2. Gassed cases should be carried by litter or ambulance -- never allowed to walk. This is important because after the initial symptoms have been relieved by the gas mask or removal from the gassed area, the soldier may feel and look quite able to walk, yet any exercise will increase the demand for air and will increase the swelling and pulmonary edema that is to come 2 to 4 hours later.



AIR SACS OF LUNG UNDER MAGNIFICATION

SHOWING INTIMATE ASSOCIATION WITH

CAPILLARY BLOOD VESSELS

3. No smoking, as this also increases the demand for air. (Cigarettes are apt to develop a nauseating taste in men gassed with Phosgene)
4. At the Aid Station clothing should be removed, as the clothes tend to absorb gas, surrounding the soldier in a poisonous atmosphere. He should then be bathed, to remove all traces of gas from the hair and skin.
5. Give hot drinks and keep warm.
6. Place soldier where there is plenty of fresh air, preferably in the wind. Whenever possible, gassed soldiers should be kept separate from other patients.
7. Transport by ambulance to a designated gas hospital or to an evacuation hospital.
8. Here, at the gas hospital, patients are observed for shortness of breath, blueness of the finger tips and lips (cyanosis) and pain in the chest. Such patients are given inhalations of pure oxygen or oxygen mixed with carbon dioxide. At times the medical officer may decide to extract 1/2 pt of blood or more from these patients.

Oxygen Therapy

Oxygen may be administered by 4 different methods.

1. Face mask and nasal inhaler.
2. Nasal catheter.
3. Oxygen tent.

Face Mask and Nasal Inhaler

The face mask and nasal inhaler are standard articles of equipment in military hospitals and are a convenient and easy method of administering oxygen therapy. (See illustration)

There are several types of face masks, some of which merely cover the nose, while others, such as the Bullowa, depend for their efficiency on 2 bent hollow metal tubes which are a part of the mask and are inserted in the nostrils. The oxygen enters the nose through these tubes. They should be greased before insertion. The oxygen should be moistened by running it through a water bottle before it reaches the nose; otherwise unpleasant dryness of the nose and throat may result.

The use of the face mask provides a concentration of oxygen in the lungs of about 30% when the gauge on the oxygen tank is set at the rate of flow of 4 liters per minute. Higher rates may be obtained by increasing the rate of flow. This is more than twice as much oxygen as exists in the deep air sacs of the lungs when only air is breathed, and should maintain life with less than half of the lung able to function.

The B L B Mask permits higher concentrations of oxygen in the lungs. (See illustration). There are 3 portholes on this mask. Their purpose is to admit air. If all of these are closed, the patient breathes pure oxygen and the oxygen concentration in the lungs may reach a concentration of 100%. Usually one or more of these portholes are left open so that the patient breathes part air and part oxygen. This mask is a standard article of equipment.

Nasal Catheter

The nasal catheter permits the administration of oxygen concentrations in excess of 50%. The technique of administration involves passing the catheter through the nostril until it appears in the back of the mouth just above the base of the tongue. If placed any lower it may touch the tongue and produce gagging. Ordinary urethral catheters, small size, such as 8 or 12 French are used. The end of the catheter directly adjacent to the tip should be perforated by several small holes in order that the stream of oxygen may not be directed entirely on one spot on the mucous membrane. Such perforations can be made by puncturing the rubber catheter several times with a hot needle.

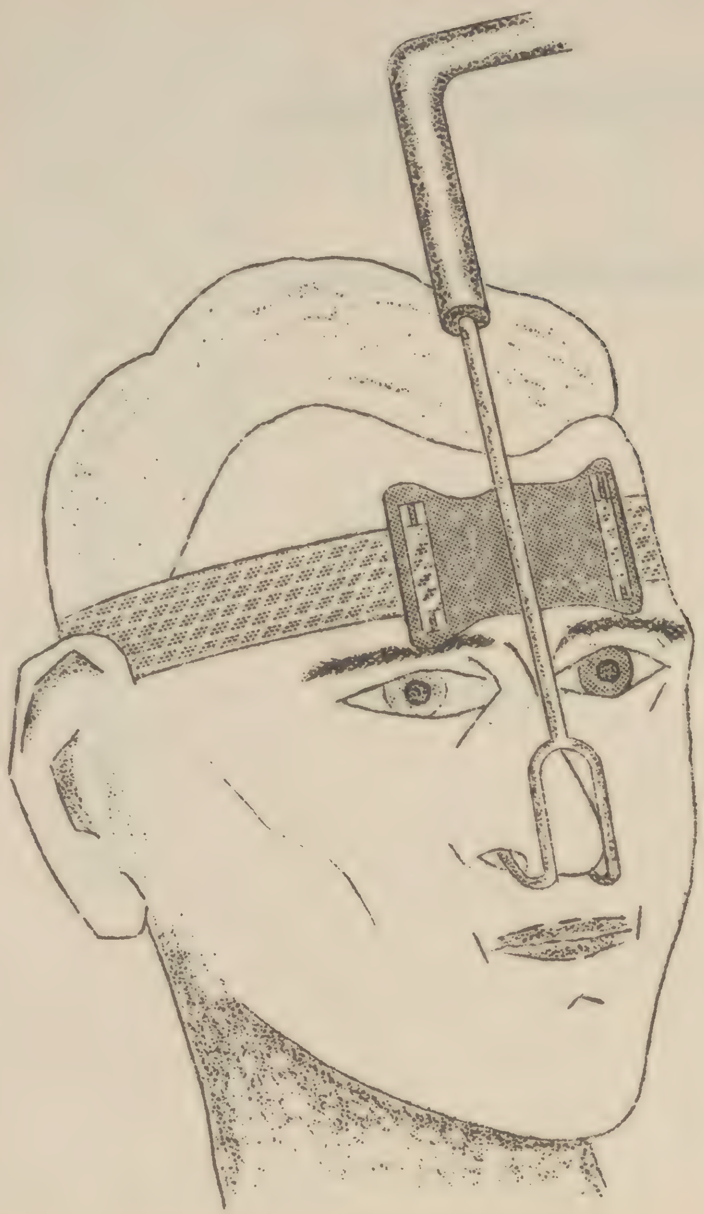
The tehcnique of placing the catheter is as follows: after all equipment is in order and connected, ready for use, the catheter to be used is examined. It should be perforated at the end by a hot needle as previously described. Most catheters have a natural "droop" in one direction which will facilitate the entrance through the nose. The direction of this "droop" is determined by rotating the catheter in the fingers, just before inserting. Next grease the catheter with vaseline to facilitate its passing and gently insert in the nostril. Thread it in as you would thread a needle. Do not use force. In this manner feed it through the nostril until it appears in the mouth, just above the base of the tongue. Inserting a catheter in this manner is not painful and can be done by anyone with enough common sense to follow directions. If any obstruction to the passage of the catheter appears, withdraw it and try the other nostril. The catheter should be inserted while the oxygen is flowing through it at the rate of 5 or 6 liters per minute.

Another method for determining the proper depth to insert the catheter is to put it in until the patient begins to swollow the oxygen coming out of the end of the tube. When this point is reached, withdraw it until he stops swollowing.

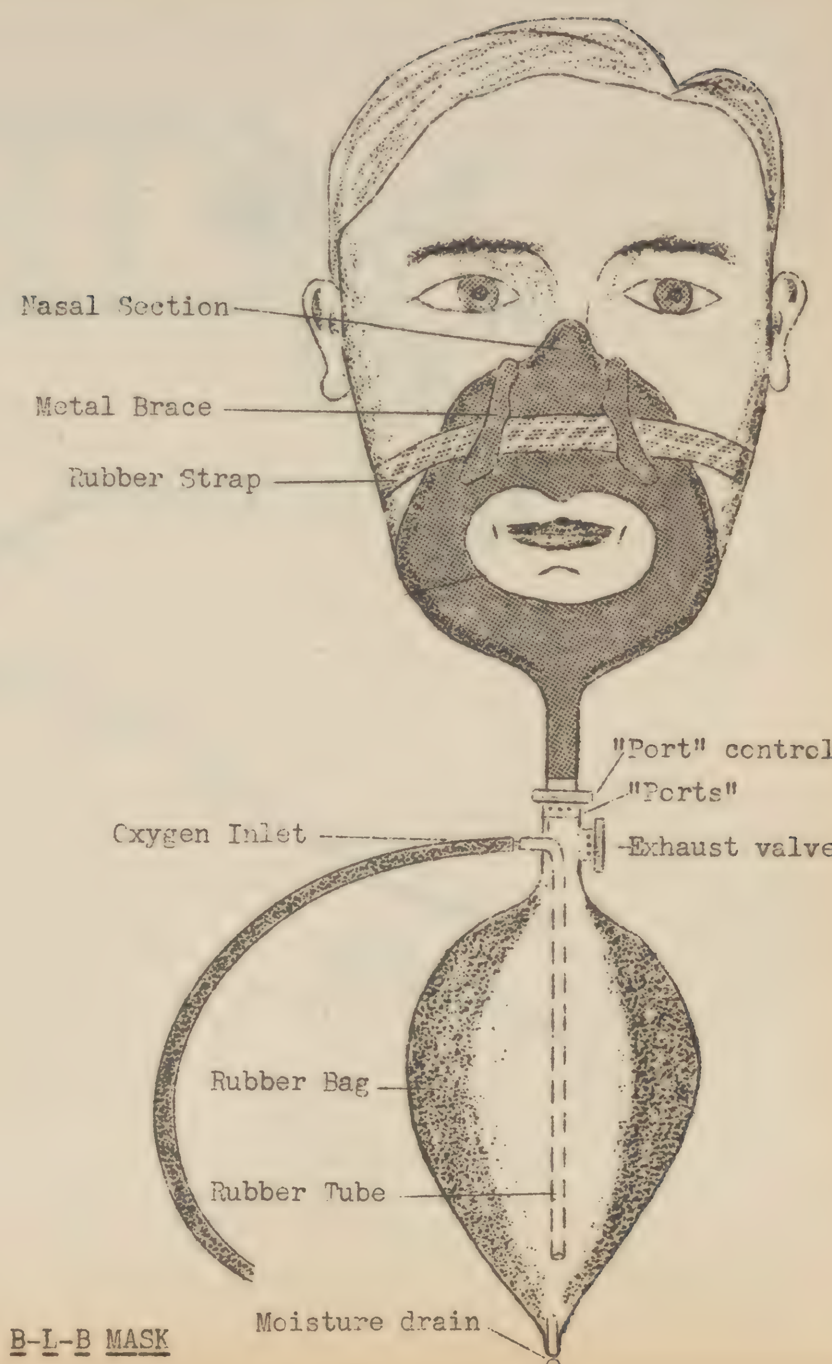
After the catheter is properly inserted, its rear end is brought up over the end of the nose and fastened down on the forehead with adhesive. After about 12 hours a catheter should be changed, using the other nostril.

Oxygen Tent

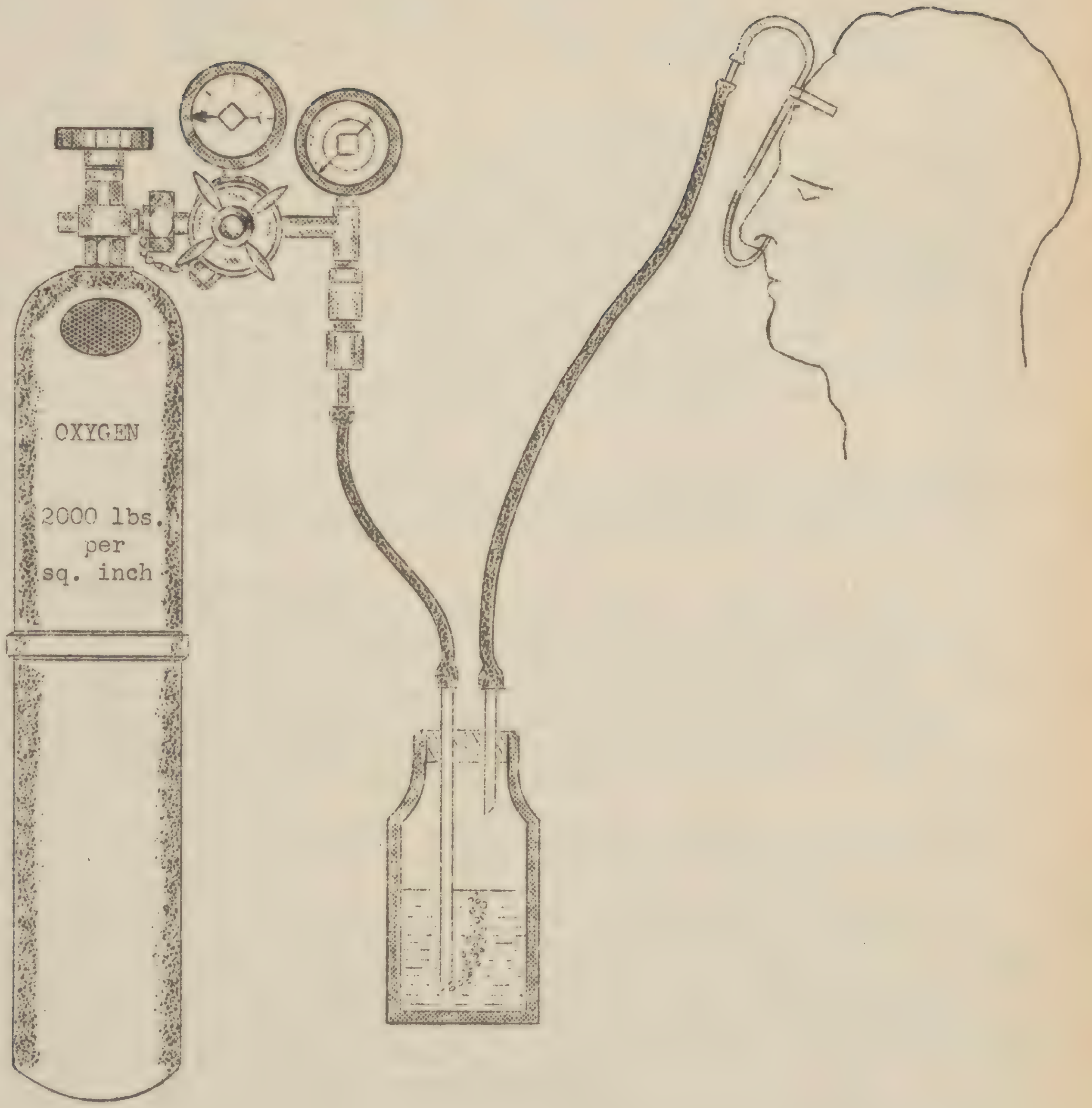
An oxygen tent is a complete and self contained portable air conditioning unit which provides the patient with comfortable conditions of temperature and relative humidity while he is breathing the prescribed concentration of oxygen. The nasal catheter provides only oxygen. The oxygen tent provides oxygen plus air conditioning. They are gas type fabric canopies, well supplied with cellophane-light windows, supported over the bed in such a way as to fully inclose the head and upper portions of the body. Connected to this canopy is a conditioning cabinet to cool and dehumidify the



METAL NASAL INHALER



B-L-B MASK



OXYGEN THERAPY APPARATUS

Oxygen Tent (cont'd)

atmosphere in the canopy by circulating it around refrigerating coils or through cracked ice. Oxygen is added to the circulating system at the proper rate to maintain the desired oxygen concentration in the tent. Oxygen tents are so bulky that it is unlikely that enough of them can be carried in the baggage of an evacuation or surgical hospital to care for all gas cases. We must expect to rely on face masks and nasal catheters.

Oxygen Chamber

These are air tight rooms through which oxygen is circulated by an air-conditioning apparatus similar to that used for oxygen tents. In most respects they are large oxygen tents, in which a whole airtight room serves as the tent. The advantage is that several patients can be treated at the same time, with the same apparatus. However, if one patient needs more oxygen than another this is a disadvantage. Oxygen chambers are more practicable for military use than tents as a room in an existing building can be made to serve as the chamber and the air conditioning apparatus is the only equipment needed to be carried with the evacuation hospital.

Recently the Army has organized Medical Gas Treatment Battalions (T/O 8-125), equipped with water tanks, shower baths and other needed equipment, for the emergency care of large numbers of gas cases.

Oxygen Tank Regulator

Oxygen is supplied in large tanks, under a pressure of 2,000 lbs. per square inch. Ordinary commercial oxygen, such as is used by welders in steel factories is quite safe and pure enough for medical use. Because of the great pressure under which it is stored, an instrument known as a "regulator" is necessary to control and measure the oxygen flow. The following rules should be observed in operating the oxygen tank regulator:

1. Before handling an oxygen regulator, any oil or grease on the hands should be thoroughly removed by washing with soap and water.
2. Before attaching the regulator to a cylinder of oxygen, the cylinder valve should be "cracked" (opened slightly and quickly closed) to blow out any dust that may have lodged in the opening.
3. After the regulator is attached to the cylinder, always make absolutely certain that the flow-adjusting screw of the regulator is released -- turned to the left until loose -- before opening the valve of the oxygen cylinder.
4. The cylinder valve should be opened slightly and slowly at first. As soon as the pointer on the cylinder-contents gauge of the regulator stops moving, the cylinder valve should be opened completely.

Oxygen Tank Regulator (cont'd)

5. Turn the adjusting screw to the right; that is, tighten it until oxygen flows through the regulator at the desired rate in liters per minute as indicated on the flow-indicator gauge.
6. When the regulator is not in use and not attached to the cylinder, always close the cylinder inlet connection with the dust plug, and release the flow-adjusting screw.
7. Never use oil or grease on an oxygen regulator, cylinder valve, or on any oxygen connections.

Oxygen tanks are tall and heavy and, therefore, should be supported at all times by strapping them to the wall or a bed. They can cause serious damage if they fall on the feet.

Oxygen itself is not explosive. However it supports combustion, that is, oxygen is the gas that makes it possible for other things to burn. In the absence of oxygen even dry shavings will not catch fire. If the oxygen supply to a fire is increased beyond the amount present in air, which is 1/5 oxygen, the fire burns more brightly. Therefore, fires, lighted cigarettes and burning matches should be kept away from the vicinity of oxygen. In its presence they burn at an alarmingly furious rate.

The Oxygen Humidifier

Whenever oxygen is used, except in oxygen tents and chambers, it must be passed from the tank through a humidifier before it reaches the patient. Such a humidifier can be made from a wide-mouthed glass bottle, half filled with water. Two small holes are bored in the cork of the bottle. Through these holes are passed glass tubes. One glass tube is long enough to reach beneath the surface of the water. This tube is connected by a rubber hose to the regulator on the oxygen tank. The other tube is shorter and goes just through the cork. This tube is connected by a rubber hose to the nasal catheter or oxygen mask. Oxygen from the tank, reduced in pressure by the regulator and flowing at the rate of 4 to 6 liters per minute, or at whatever rate the regulator has been set, flowsthrough the long glass tube and bubbles out beneath the surface of the water. It then rises to the space above the water and escapes through the short glass into the nasal catheter. This is both a humidifier and a safety device. The oxygen bubbling through the water becomes moistened and if anything should go wrong with the regulator so that the 2,000 pounds per square inch pressure gets out of control, the bottle will blow up and the patient will not be injured. (See Illustration)

Care of the Eyes and Throat

Phosgene, Chlorine and Chloropicrin may cause severe eye discomfort, consisting of itching and burning. They also cause dryness and discomfort in the throat. Permanent injury to the eyes does not occur.

Care of the Eyes and Throat (cont'd)

Treatment consists of washing the eyes frequently with 2% soda bicarbonate solution. This is made by dissolving 1 teaspoonful of baking soda in 1 glass of water. Needless to say, clean water should be used. This same solution may also be used as a gargle for the throat. 2% boric acid solution or a solution made by dissolving 1 teaspoonful of table salt in 1 pint of water may also be used.

Should pain continue in the eyes after the above mentioned treatment, a local anaesthetic may be dropped in the eye, such as 2% butyn sulphate. 1/4% neosynephrin hydrochloride will also give relief from its astringent action. Cocaine should not be used as it tends to cause ulceration. Never bandage the eyes, as bandaging tends to encourage infection and the formation of pus, which might result in permanent eye injury. If light seems to hurt the eyes, keep the patient in a dark room or give him dark glasses or an eye shade.

Another solution that can be used to drop in the eye for the relief of pain and discomfort is the following:

Neosynephrin HCl 1%----------------25 cubic centimeters
Pontocain----------------------------.25 grams
Boric acid, saturated solution-----75 cubic centimeters

After 72 hours the pulmonary edema will begin to subside and oxygen therapy can be gradually discontinued. During convalescence, the soldier is given daily exercise in gradually increasing amounts, starting with sitting on the edge of the bed or in a chair. Exercise is always discontinued if shortness of breath or pain in the chest returns. By the end of 3 or 4 weeks the soldier should be ready to return to his organization, if no complications have occurred.

Complications which occur in a very small proportion of lung irritant gas cases are:

1. Reactivation of an old quiescent tuberculosis.
2. Pneumonia.
3. Lung abscess

TREATMENT OF CASUALTIES CAUSED BY THE VESICANT AGENTS

The vesicant agents are: Mustard -- HS -- and Lewisite -- M-1. Mustard is a heavy oily liquid with a garlic like odor. It smells stronger than garlic and can be detected by its odor in very minute amounts. It is used to contaminate ground and buildings so as to make their use dangerous to troops.

Burns from Mustard occur if it is allowed to remain on the skin for 20 minutes, but the burn itself will not appear for from 2 to 4 hours. In this respect it closely resembles a burn from strong sunshine. The burn may be simply 1st degree, consisting of redness of the skin, or it may be 2nd degree with large blisters. The skin around the burn has a dirty white or greyish appearance. This discoloration appears before the burn itself.

TREATMENT OF CASUALTIES CAUSED BY THE VESICANT AGENTS (Cont'd)

Certain parts of the body, such as the eyes, armpits and groin, where the surface is tender and moist are often burned first. Burns from Mustard occur characteristically in scattered places over the body, the soldier picking up a drop or two on his uniform here and there as he carefully makes his way through contaminated underbrush.

Mustard is easily absorbed by clothes and will soak through the service uniform and cause burns beneath it. It will even soak through the soles of the shoes and burn the feet. Soaking through the uniform takes time and the soldier has ample opportunity to remove the damaged clothes and prevent a burn, if he can detect and heed the smell of garlic.

If Mustard vapor is breathed, it acts like a lung irritant and is 4 times as poisonous as Phosgene. However, this is such a heavy liquid that vapor from it will not remain suspended in the air very long after the shell bursts.

Mustard is not very soluable in water. It is heavy and remains an active chemical agent for 3 or more weeks in hot weather -- for several months in cold weather. It is, therefore, called a "persistent" chemical agent.

Both Mustard and Lewisite are easily destroyed by alkaline chemicals, such as Lime, Ammonia, Lye and by such oily substances as gasoline, kerosene and benzine. Chlorine, in the form of bleaching powder, or the commercial bleachers,such as Chlorox and Purex, also destroy Mustard. These chlorine preparations are similar to the chlorine solutions used in shower baths to prevent Ahtlete's Foot. Carbon Tetrachloride, a commercial spot remover, and non-inflammable, sold under the name of Carbona, will also destroy Mustard and Lewisite. Soap and water is also effective.

Curiously, animals, although susceptible to Mustard burns like humans, frequently escape because their hair is a protection. The hair, while protecting the animal from burns, may carry the Mustard or Lewisite droplets for hours or days. For this reason, soldiers who are assigned to the care of such animals may burn their hands from contact with the animal's hair, even though the animal may now be miles away from the place where the Mustard attack occurred. Such soldiers should,of course, protect their hands with gloves.

Contact with Mustard often produces no immediate discomfort. If the Mustard is not removed in 20 minutes, a slight burn is likely, and, if allowed to remain on contact with the skin for a longer period of time, the burn will be more severe. The first sign of the burn is redness and a dirty appearance of the skin, coming on after 2 to 4 hours. In severe burns, blisters appear some time later. Death seldom results from Mustard burns and if it occurs it is usually due to a secondary infection in the burn or to a bronchial pneumonia from inhaling the fumes.

After a few weeks the skin over the burn peels off in the same manner as after a bad sun burn.

Usually, even in severe cases, the eyes recover without damage. Of the 783 men in the United States Army who were blinded in one or both eyes during the last war, only 32, or less than 4% of these men were blinded by Mustard or other gases.

Drinking water, contaminated with Mustard, produces severe nausea and vomiting. Water that is contaminated with Mustard and other warfare gases should be avoided if other supplies can be obtained. If not, contaminated water will be considered as potable, provided it meets all of the following requirements:

1. There is no odor of any chemical agent present before chlorination.
2. There is no excessive cloudiness or other discoloration.
3. The addition of 5 parts per 1,000,000 or Chlorine (2 ampules of Calcium Hypochlorite per Lister bag) produces a Chlorine residual of 1 part per 1,000,000 or more.
4. The pH (acidity) of the water before chlorination is above 5.0

These tests apply to all known warfare gases that may contaminate water supplies. Treatment of contaminated water to render it potable is risky except by water supply personnel of the Division Engineer Regiment or Battalion, or of the Engineer Water Supply Battalion. (FM 21-40)

Management of Mustard Cases

1. The soldier himself, or his Company Aide man, on discovering he has been contaminated by Mustard, takes off the clothes from the affected part, and, after wiping off any excess or visible Mustard, applies the M-1 Ointment that he carries with him. This is stirred around the affected part with a stick or pencil. He then goes back to the Battalion Aid Station. He can walk or run back, unless he has inhaled some Mustard vapor.
2. At the Aid Station, the personnel on duty, members of the Medical Detachment, remove his clothing and equipment and apply treatment under the direction of the Medical officer; such treatment will vary with the materials available, but will be along these lines:
   (a) Remove remaining Mustard on the skin by rubbing with more M-1 Ointment and wiping off. The skin may also be washed with a Chlorine solution, such as Dichloramine-T solution, Athlete's Foot preventive solution or Chloride of Lime dissolved in water. Another method is to wash the skin with gasoline, kerosene, alcohol or Carbon Tetrachloride (a commercial spot remover known as "Carbona.")
   (b) Wash the entire body with soapy water. GI soap is the best. Pat the washed area dry with a gauze sponge. Do not wipe with a towel. Sponges so used must be burned.

Management of Mustard Cases (cont'd)

(c) If the burn has not yet appeared, the application of pure Amyl Salicylate daily for several days helps lessen the swelling and produces a comfortable feeling. Amyl Salicylate may either be sprayed on or applied by mopping the skin with gauze dipped in the drug.

(d) If the soldier arrives at the Aid Station with redness of the skin already present, Dichloramine-T or other Chlorine preparations should not be used to clean off the skin. Neither should M-1 Ointment be used, as it increases the redness. Instead use only kerosene, Carbon Tetrachloride or soapy water.

Treatment of the Burn After it Develops

If, in spite of preventive treatment, as outlined above, a burn does develop, the soldier should be evacuated by ambulance to an evacuation or designated gas hospital, where the burn will be treated like other burns. Burns covering portions of the face, hands and small areas on other parts of the body will, probably, receive frequent applications of a solution known as Triple Dye. This dye is made in the following manner. Equal parts of the 3 solutions listed below are mixed together.

Brilliant green ------------ 1 part to 400
Gentian violet ------------- 1 part to 400
Acriflavin, neutral -------- 1 part to 1000

This dye mixture is painted on the burn and forms a thin crust beneath which healing takes place. The purpose of the dye is not only to increase the soldier's comfort -- it greatly reduces the chances of infection. It is infection in burns which is responsible for the scar and for most of the deaths.

Tannic acid solution in water, 5%, may also be used, followed by 10% silver nitrate. It produces a similar but thicker crust, which, if used on the hands or face, may prove uncomfortable.

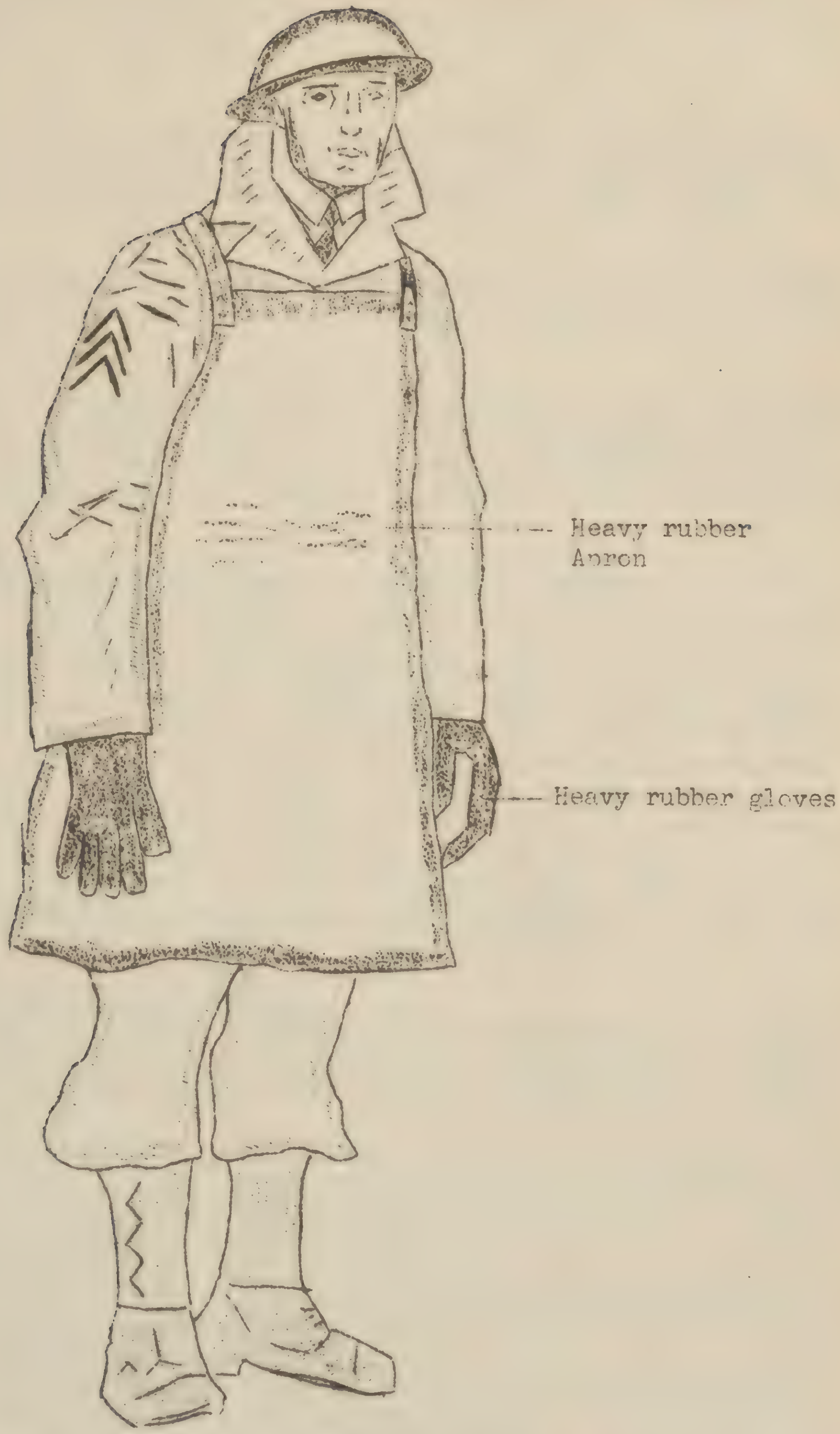
Extensive burns, covering an area equal to 1/4 of the body's surface, will require treatment for shock, as in other kinds of burns. Such patients will require the intravenous injection of blood plasma and salt solution.

Treatment of the Eyes

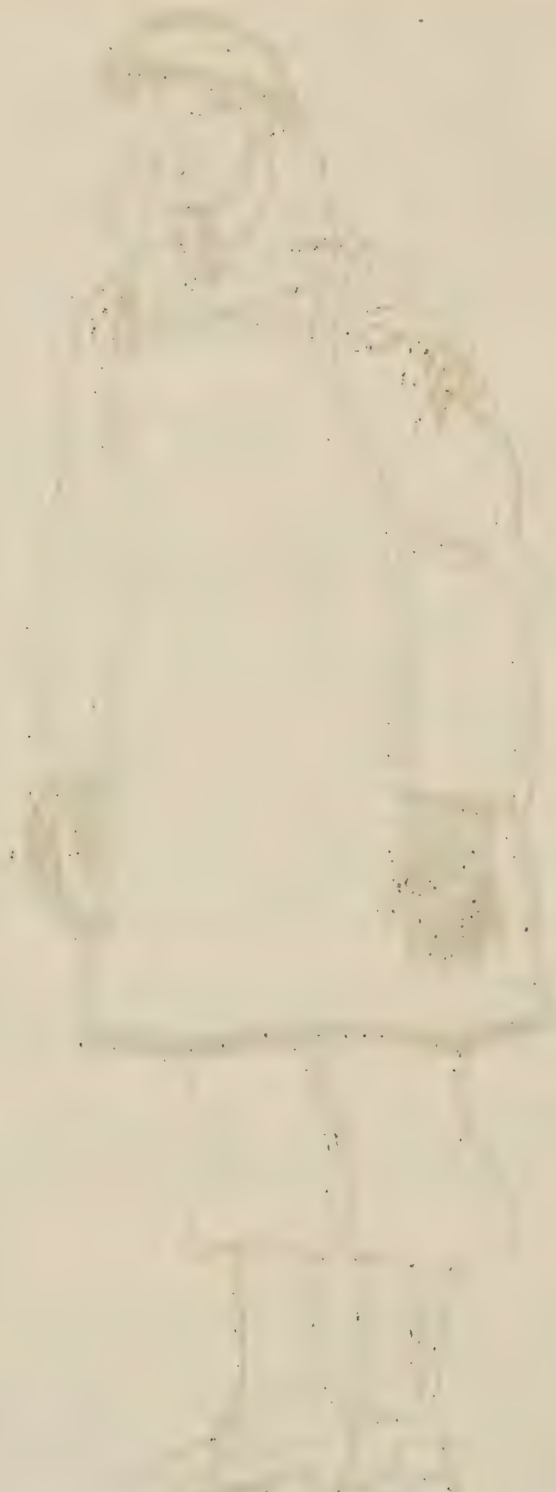
Burns of the eyes are very common from Mustard. Fortunately, permanent damage is rare. The eyes should be irrigated frequently with 2% soda bicarbonate solution (baking soda), normal salt solution (1 teaspoonful of salt to a pint of water) or 2% boric acid. 1/2% Dichloramine-T, dissolved in normal salt solution, may also be used. For those who have great discomfort, some drops of the following prescription may be put in the eyes:

Neosynephrine HCl 1% --------- 25 cubic centimeters
Pontocain ------------------- .25 grams
Boric acid saturated solution- 75 cubic centimeters

Cocaine should not be used as there is danger of ulceration. An eyeshade or keeping the patient in semi-darkness will add to his comfort. Do not bandage the eyes.



Soldier dressed for care of casualties injured by vesicants.



Treatment of the Eyes (cont'd)

As the reader now knows, the treatment for Mustard burns of the eye differs little from the treatment for Phosgene, Chlorine or Chloropicrin in the eyes.

Lewisite

Lewisite smells disagreeably like geraniums. The Japanese are said to have developed a kind of Lewisite which has practically no odor. This new Lewisite can be detected by other means. A piece of blue Litmus paper will turn red in its presence.

Lewisite resembles Mustard, except that it burns much more quickly (within 2 minutes) and M-1 Ointment must be applied within 1 minute to be effective.

Lewisite is a heavy oily liquid like Mustard, but contains arsenic. There is, therefore, some danger of arsenic poisoning from it if inhaled, and if much Lewisite is caught in the blister of the burn. These blisters should, therefore, be opened to let the fluid escape.

Treatment

Treatment of Lewisite burns is similar to treatment of Mustard burns, except that Chlorine preparations, such as Dichloramine-T should not be used for cleaning. Use Peroxide of Hydrogen 8% strength instead. 1/2% Potassium Permanganate solution may also be used. Do not use M-1 Ointment to treat a Lewisite burn. It makes it worse. Treatment of the eyes and treatment of burns on the skin after they appear is the same as for Mustard except that blisters must be broken. Chlorine solutions must not be used to irrigate the eyes in Lewisite burns. Other solutions used for Mustard burns of the eye, such as 2% baking soda and normal saline, must be used continuously for a long time to bring relief. The anaesthetic drops previously mentioned, under Mustard burns, are also useful for Lewisite.

Protection of Medical Personnel

Surgical and Medical Technicians who care for Mustard or Lewisite casualties must take careful precautions or they, too, will be burned from contact with the chemical agent on the patient; such precautions are:

1. Wear some kind or protective clothing, a rubber apron or the service raincoat, a mask on the face, and heavy rubber gloves.
2. Frequently remove the mask and gloves and wash the hands in Dichloramine-T, Athlete's Foot preventive, or a solution of lye, made by putting 2 teaspoonsful of lye in 1 quart of water. In treating Lewisite burns, the hands and face should be washed in Peroxide of Hydrogen or 1/2% Potassium Permanganate solution.

   CAUTION: Ordinary surgical rubber gloves are too thin to afford much protection against vesicants. These chemicals become dissolved in the rubber and spread, so that a small drop that would produce only a small burn on the bare hand

Protection of Medical Personnel (cont'd)

will spread in the rubber and soak through it to produce a large burn. If surgical rubber gloves must be used, wear 2 pair. Wet the first pair with 1% lye solution. This is made by dissolving 1 teaspoonful of lye in 99 teaspoonsful of water. Change the gloves every 15 minutes, first washing them in the lye solution. Each time the gloves are removed, wash the hands also in the lye solution, or kerosene or Carbon Tetrachloride. These last two substances should not be used on the rubber gloves as they dissolve rubber.

Disposal of Dressings & Clothing from Vesicant Gas Casualties

All dressings, washcloths and other material used to treat vesicant gas casualties should be burned. Clothing should also be burned. The fumes from these fires may contain enough poisonous chemical to produce lung irritation if inhaled, so such fires should be downwind from the Aid Station or Evacuation Hospital. Where no other clothing is available, contaminated clothing may be rendered safe for use by steaming it for 2 hours in a Serbian barrel, or by soaking in repeated changes of gasoline and then washing with soap and water, followed by hanging out to dry in the bright sunshine for a week. Bleaching solutions, such as Athlete's Foot preventive, Chlorox or Purex, will render the clothing safe, but will also bleach it white, so it should only be used on underwear, socks and other white articles of clothing. Equipment can be decontaminated by washing in gasoline or kerosene, followed by soap and water, if suitable. Small areas of ground may be rendered safe to walk on by covering with 6 inches of sawdust and rolling it down.

Mustard and Lewisite burns take a long time to heal. Such casualties may require hospitalization for from 4 to 6 weeks.

LACRIMATORS

The two common lacrimators are: Brombenzlcyanide and Chloracetephenone. Chloracetophenone is the most common one. It smells like apple blossoms and has the chemical warfare symbol CN. These are frequently fired in hand grenades. A new type of hand grenade is designed so that it gets very hot as soon as it is thrown to prevent enemy troops from picking it up and throwing it back again. Lacrimators may be used to favor the capture of enemy troops in order to obtain information from them. They also may be used in connection with poisonous lung irritants such as Phosgene, so as to distract the soldier's attention by the burning of the eyes and the intense flow of tears and cause delay in putting on the gas mask. Lacrimators cause no permanent damage but completely disable troops exposed to them by causing intense crying and swelling of the eyelids, completely obstructing vision.

Treatment

Face the wind and open the eyes. This will usually give quick relief. The eyes will sometimes get further relief by drops of the following solution:

Sodium Sulphite ----------	.4 grams
Water, distilled ---------	25 cubic centimeters
Glycerin -----------------	75 cubic centimeters

These cases need never be evacuated beyond the Battalion Aid Station.

IRRITANT SMOKES OR STERNUTATORS

These are: Adamsite -- DM and Diphenylchlorarsine -- DA

Adamsite is yellowish smoke and Diphenychlorarsine is greyish. Both produce nausea, vomiting and headache, while Diphenylchlorarsine produces sneezing also. There are no permanent effects. Evacuation is seldom necessary beyond the Aid Station. Treatment consists of removal from the gassed area and rest with fresh air. Apply vaseline to the nostrils. These casualties can usually walk to the Aid Station.

INCENDIARIES

These are: White Phosphorus -- WP -- and Thermite -- Th

These are used to start fires in towns, barracks and supply dumps. White Phosphorus is not as good at this as the others and is more often used to produce a dense cloud of white smoke to screen troop movements. Occasionally troops near a burst of a White Phosphorus bomb may be burned by flying particles of Phosphorus. This smells like wet matches and bursts into flame on exposure to air. The burning Phosphorus sticks to the flesh so well that it cannot be brushed off. The best thing to do is to immerse the burning part in water. While under water, someone should pick out the Phosphorus particles with tweezers or tissue forceps. Do not remove the burning part of the body from the water until this is done. Access to air will cause the Phosphorus to burst into flame. Lacking water, wet mud can be heavily smeared on the burning part. If available quickly, a solution of Copper Sulphate, 5% will coat the Phosphorus and exclude the air from it. The particles must then be picked out.

Thermite -- Th -- is used as a filling for magnesium bombs. Thermite is a mixture of equal parts of finely powdered aluminum and iron rust. When ignited it burns easily, liberating a temperature of 4,500 degrees, hot enough to melt any known metal. Magnesium bombs containing Thermite are usually dropped from planes in large clusters. They are so light they will seldom penetrate farther than the roof of a house. Fires from them generally start in the attic. These fires may be extinguished by squirting a heavy stream of water on them, or by covering them with shovelsful of sand and then shoveling the bomb and sand together into an iron pail, which must be carried on a broomstick by 2 persons and dumped in a safe place. Be sure to put sand in the bottom of the pail or the bomb will burn right through it. Remember that the bomb liberates too much heat to permit holding the pail by the handle.

Those who pick up these bombs on shovels, even after the bomb is covered with sand, need some protection over the face and gloves on the hands. Burns from magnesium bombs are treated as any other burn. They are usually small in area and not dangerous, but may be very painful and slow to heal, because of their depth.

INCENDIARIES (cont'd)

These bombs are easy to put out. Their effectiveness in starting fires is due to the practice of dropping such a large number of them at once that all the fires cannot be promptly dealt with. In the 1940 raids on London, the Germans first dropped high explosive bombs. They later found that the same weight of incendiary bombs would produce more damage and they followed this practice in their later raids. All magnesium bombs will burn themselves out in a few minutes.

MISCELLANEOUS GASES

There are other possible warfare gases, among these are: Hydrocyanic Acid Gas and Carbon Monoxide Gas. Hydrocyanic Acid Gas is extremely poisonous in very weak dilutions. It is not a lung irritant. Its poisonous effects are due to its capacity for paralyzing the nervous system. Hydrocyanic Acid Gas smells like almonds. Fortunately there are physical reasons why this gas is not appropriate for use in warfare. One of these reasons is that this gas is so light that it ascends in air. Therefore, large poisonous clouds of it will not remain close to the ground in contact with troops.

Carbon Monoxide Gas is very cheap to make, is colorless and absolutely odorless. It is produced when any cumbustible material is burned with an insufficient amount of oxygen. It is present in the exhaust of automobiles. Coal stoves are apt to leak Carbon Monoxide when the damper is closed. This gas is also lighter than air, so that its use as a warfare gas is not likely.

Occasional poisoning from Carbon Monoxide may occur in war in places where large numbers of high explosive shells or bombs have exploded in rapid succession. Powder in large shells is sometimes imperfectly burned, producing Carbon Monoxide. In narrow streets or ravines enough Carbon Monoxide may accumulate from such explosions to cause poisoning.

Carbon Monoxide poisons by reducing the capacity of the blood to carry oxygen. Persons poisoned with it are seldom aware that they are in danger. The first signs of poisoning are a feeling of ease and comfort, followed by drowsiness, followed by a deep sleep. If not promptly rescued, the poisoned person will die. Exposure to Carbon Monoxide poisoning in amounts insufficient to cause drowsiness produces chronic headache and general weakness.

Treatment for Carbon Monoxide poisoning is fresh air, and, if the patient has stopped breathing, artificial respiration.

Persons who have died from Carbon Monoxide poisoning have a livid red color over the whole body.

Carbon Monoxide is rapidly dissipated by wind and becomes oxidized to Carbon Dioxide, which is harmless. Poisoning from it is not likely in the open field in the presence of wind.

QUESTIONS AND ANSWERS

1. Q. What is a chemical agent?
   A. A chemical agent is a substance useful in war which, through its ordinary chemical properties, produces a toxic or irritant effect on the body; a screening smoke; or an incendiary action.

2. Q. How is the amount of chemical agent in the air (i.e., the concentration) expressed?
   A. In parts per 1,000,000

3. Q. How does the concentration of a chemical agent in the air influence the effect produced by exposure to the agent?
   A. The higher the concentration, the greater is the effect upon exposure to any agent for a given length of time.

4. Q. What is meant by harassing concentration?
   A. Harassing concentration is that concentration of agent in air which forces exposed personnel to seek protection.

5. Q. What is lethal concentration?
   A. Lethal concentration is that concentration which will kill more than half of the test animals (dogs) upon exposure for a given period of time, i.e., the lethal concentration of CG is .29 of an ounce per 1000 cubic feet for 30 minutes.

6. Q. How are chemical agents classified according to their effect upon the human body?
   A. They are identified according to the principal action which they produce upon the human body. However, it is to be remembered that practically all agents have an additional or secondary effect. According to the principal action of the agents upon the body, they are classified as follows:
      a. Lung irritants: These are the agents which, when breathed, affect the respiratory tract. (Example: Phosgene, CG; Chloropicrin, PS)
      b. Lacrimators: Exposure to these agents causes an intense temporary irritation of the eyes and copious flow of tears. (Example: Tear Gas, CN)
      c. Vesicants: Either in liquid or vapor form these agents, upon contact with any part of the body, produce large water blisters which require a long time to heal. (Example: Mustard Gas, MS; Lewisite, M-1).
      d. Irritant Smokes: These agents which breathed in smoke clouds cause sneezing, intense irritation of the nose, headache, nervous depression and nausea. (Example: Adamsite, DM)
      e. Incendiaries: When particles of these agents come in contact with the body they produce painful heat burns which are very slow to heal. (Example: White Phosphorus, WP)

7. Q. What protection is needed against any agent that must be breathed in order to be effective?
   A. The military gas mask (only) is necessary for complete protection against such agents.

8\. Q. Is the military gas mask adequate protection against vesicants? Why?
A. No. The vesicant (either liquid or vapor) attacks any part of the body with which it comes in contact. Therefore, all parts of the body must be protected from this type of agent if the protective measures are to be effective.

9\. Q. How may various chemical agents be recognized in the field?
A. Chemical agents in the field may be recognized by their odors and their immediate effects on the body. (See accompanying Table).

10\. Q. What is the symbol for each of the important chemical agents? What is the characteristic odor of each. What are the other immediate effects of these agents on the body?
A. The above information is given in the accompanying Table. All members of the armed forces should have this information well in mind.

11\. Q. What effect does Mustard Gas produce on an individual in addition to its blistering or vesicant action?
A. Exposure to Mustard gas vapor produces inflammation of the eyes when the face is not protected. If mustard gas vapor is breathed, severe lung irritation is produced.

12 Q. How can chemical shell be distinguished from HE shell fired in an attack?
A. A chemical shell, containing a liquid can often be distinguished in flight from other shell by the peculiar intermittent shirring noise it makes and usually by its low detonation sound. At the point of burst, a HE shell produces a black smoke, whereas chemical shells produce a thin, whitish smoke.

13\. Q. What are the effects, and how soon will these effects show up, after a man is exposed to the following agents?
- a. Phosgene (CG) high concentrations
- b. Phosgene (CG) low concentrations
- c. Mustard gas (HS) vapor concentrations
- d. Mustard gas (HS) splashed with the liquid
- e. Adamsite (DM) irritant smoke cloud
- f. Tear gas (CN) cloud

A. a. Phosgene in high concentrations produces immediate injury to the lungs, manifested by gasping, painful breathing and weakness.
b. Phosgene in low concentrations is not irritant, but when breathed for some time may produce a type of chemical pneumonia. The effect of Phosgene in low concentrations is greatly intensified if the individual is called upon to work, to march, or is exposed to the cold after breathing the Phosgene.

c. Mustard gas vapor produces eye burns and severe lung irritation if breathed, and produces blisters on the tender, moist parts of the body. These effects may show up in from 2 to 4 hours or longer after the exposure.
d. Liquid Mustard gas produces large, watery blisters which appear in from 2 to 4 hours after contact.
e. Adamsite, in the form of irritant smoke, produces burning of the nose, nausea, vomiting, sneezing, headache and muscular weakness. These effects appear in from 2 to 30 minutes after exposure, depending upon the concentration breathed and the length of exposure.
f. Tear gas (CN) in a cloud produces an immediate stinging of the eyes and a copious flow of tears. If the concentration is high, a man finds it impossible to keep his eyes open during the period of exposure and for 10 to 15 minutes after leaving the gas cloud.

14. Q. In order to avoid burns, first aid must be applied at what time in the case of HS and M-1?
A. For HS -- within 10 minutes.
For M-1 -- within 2 minutes.

15. Q. Does a cloud of chemical agent produced from a bursting artillery shell move with the wind?
A. Yes. The cloud travels downwind, gradually increasing in height, width and depth.

16. Q. Chemical agents, as used in the field, have varying degrees of persistency. Explain the meaning of persistency, and state the factors which affect persistency. How are chemical agents classified according to their persistency?
A. The length of time an agent remains effective at the point of release is called the "persistency" of that agent. Persistency is affected by: (a) the tendency of the agent to vaporize; (b) temperature, wind velocity, and other weather conditions; (c) the munition from which the agent is disseminated; (d) terrain, soil and vegetation. Chemical agents which evaporate within 10 minutes or which form a smoke cloud upon release, are called "nonpersistent" agents. Those agents which remain at the point of release in dangerous amounts for 10 minutes, are called "persistent" agents. For example: Phosgene (CG) is a nonpersistent agent, as is Irritant Smoke (DM). Mustard (HS) may remain effective for days under certain conditions and is thus highly persistent

17. Q. How are chemical shells marked for use in the field?
A. 1 green band indicates a nonpersistent casualty agent.
2 green bands indicate a persistent casualty agent.
1 red band indicates harassing agents.
1 yellow band indicates a screening smoke.
1 purple band indicates an incendiary.

18. Q. What kind of damage do the lung irritants do to the lungs?
    A. They cause pulmonary edema, which is an inflammation of the lung air sacs, causing them to swell and fill with fluid, which excludes the air.

19. Q. What treatment would you give a severe lung irritant poisoning case?
    A. First remove clothing and bathe. Administer hot drinks if he is not vomiting. Evacuate by ambulance to a properly designated gas hospital, where he will get inhalations of oxygen.

20. Q. About how long do lung irritant gas cases remain in the hospital?
    A. From 3 to 4 weeks.

21. Q. Why should you not bandage the eyes of gas patients?
    A. Bandaging tends to increase the possibility of infection. Infection of the eye is more apt to damage it than gas. Discomfort due to light can be relieved by dark glasses or a dark room.

22. Q. Name 4 ways to administer oxygen.
    A. 1. Face mask and nasal inhaler.
       2. Nasal catheter.
       3. Oxygen tent.
       4. Oxygen chamber.

23. Q. How is the nasal catheter inserted in the nose for oxygen therapy?
    A. Grease the catheter with vaseline, connect it to the oxygen equipment, so that a stream of oxygen is running through it at the rate of 4 liters per minute and gently ease the catheter through one of the patient's nostrils until it appears in the patient's mouth, just above the base of the tongue. Withdraw the catheter slightly, if it is inserted so deeply as to cause gagging.

24. Q. What is the purpose of a "regulator" on an oxygen tank?
    A. The regulator permits a reduction of the 2,000 lb. per square inch pressure in the oxygen tank to a tolerable pressure in the nasal catheter, and makes it possible to measure the amount of oxygen the patient gets per minute.

25. Q. Why is a "humidifier" used in administering oxygen and how do you make one?
    A. A humidifier is used to moisten the oxygen which is irritating to the nose and throat, if dry. It is also a safety device which will break the connection between the pressure in the the oxygen tank and the patient in case the regulator on the oxygen tank should fail to function. A humidifier is made

by taking a large glass bottle, preferably with a wide mouth, stoppered by a cork -- two holes are bored in the cork. Through one hole a long glass tube is inserted, and through the other, a short glass tube. The bottle is half filled with water and the long glass tube connected to the outlet on the regulator. The short glass tube is connected to the nasal catheter or oxygen mask. The oxygen then passes through the long glass tube and bubbles up through the water in the bottle and escapes through the short glass tube to the patient.

26. Q. What precautions should be taken when oxygen is being used?
A. Keep lighted cigarettes, matches and other fire away, as these will burn with almost explosive force in the presence of oxygen; keep the oxygen tank supported by a strap or rope to the wall or a bed so that it will not fall over.

27. Q. Which burns quicker, Mustard or Lewisite?
A. Lewisite.

28. Q. How soon must M-1 Ointment be used to protect against a Mustard burn?
A. Within 10 minutes.

29. Q. How soon must M-1 Ointment be used to protect against a Lewisite burn?
A. Within 1 minute.

30. Q. When should M-1 Ointment not be used on Mustard or Lewisite burns?
A. After redness appears.

31. Q. Are Mustard and Lewisite burns apt to be fatal?
A. Mustard and Lewisite burns are seldom fatal. They do, however, produce prolonged disability, and will usually require several weeks of hospitalization.

32. Q. What is the chief difference in the emergency treatment of Mustard and Lewisite burns?
A. Mustard burns are best cleaned with a Chlorine preparation, such as Diochloramine-T. Lewisite burns are best cleaned with Peroxide of Hydrogen. Chlorine preparations are bad for Lewisite burns.

33. Q. How should the technician protect himself when he is treating fresh vesicant gas cases?
A. He should wear a mask, rubber gloves and rubber apron, or the service raincoat. He should frequently wash his face and hands in 1% Sodium Hydroxide (Lye) or soap and water. He should avoid surgical rubber gloves, as they are too thin to give much protection.

34. Q. What emergency treatment would you use for Phosphorus burns?

A. Place the burned part under water, and, while under water, pick out the burning pieces of Phosphorus. Phosphorus bursts into flame on exposure to air, so all the particles must be picked out while under water or they will start to burn again.

REFERENCE AND TRAINING CHART

CHEMICAL WARFARE

CLASS	NAMES AND SYMBOLS	FORM	ODOR	PHYSIOLOGICAL EFFECT	TACTICAL CLASS	PROTECTION
VESICANTS	MUSTARD $S(CH_2CH_2)_2Cl_2$ Di-Chlorethyl Sulfide	LIQUID AND VAPOR	Garlic, Horseradish, Mustard	Delayed effect. Burns skin membrane. Inflammation respiratory tract leading to pneumonia. Eye irritation, conjunctivitis		Gas Mask Protective Clothing
	LEWISITE $CHClCH\text{-}AsCl_2$ Chlorvinyl-Dichlorarsine	LIQUID AND VAPOR	Geraniums	Burning or irritation of eyes, nasal passages, respiratory tract, skin.		Gas Mask Protective Clothing
	ETHYLDICHLORARSINE $C_2H_5\text{-}AsCl_2$	LIQUID & VAPOR OR GAS	Stinging like pepper in nose	Causes blisters, sores paralysis of hands, vomiting. Severe on long exposure		Gas Mask Protective Clothing
LUNG IRRITANTS	CHLORINE Cl_2	GAS	Highly pungent	Lung irritant.		Gas Mask
	CHLORPICRIN CCL_3NO_2 Nitrochloroform	GAS	Flypaper, anise	Causes severe coughing, crying, vomiting		Gas Mask
	DIPHOSGENE $ClCOOC\text{-}Cl_3$ Trichlormethyl Chloroformate	GAS	Ensilage, acrid	Causes coughing, breathing hurts, eyes water, toxic		Gas Mask
	PHOSGENE $COCl_2$ Carbonyl Chloride	GAS	Musty hay, green corn	Irritation of lungs, occasional vomiting, tears in eyes, doped feeling. Symptoms delayed occasionally.		Gas Mask
LACRIMATORS	CLORACETOPHENONE $C_6H_5CO\text{-}CH_2Cl$	GAS	Apple blossoms	Makes eyes smart. Shut tightly. Tears flow temporary		Gas Mask
	BROMBENZYLCYANIDE $C_6H_5CH\text{-}BrCN$	GAS	Sour fruit	Eyes smart, shut, tears flow. Effect lasts some time. Headache.		Gas Mask
STERNUTATORS	ADAMSITE $(C_2H_4)_2\text{-}NHAsCl$ Diphenylaminechlorarsine	GAS	Coal-Smoke	Causes sneezing, sick depressed feeling, headache.		Gas Mask
	DIPHENYLCHLORARSINE $(C_6H_5)_2\text{-}AsCl$	SMOKE	Shoe polish	Causes sick feeling and headache.		Gas Mask
SMOKES	H C MIXTURE $ZN \div C_2Cl_6$	SMOKE	Sharp-Acrid	Harmless		None needed
	SULPHUR TRIOXIDE $SO_3 \div SO_2HCl$ In Chlorsulfonic Acid	SMOKE	Burning matches	Causes prickling of skin, flow of tears		Gas Mask
	TITANIUMTETRACHLORITE $TiCl_4$	SMOKE	Acrid	Harmless.		None needed
INCENDIARIES	WHITE PHOSPHORUS P	SMOKE	Burning matches	Burning pieces, adhere to skin, clothing.		None needed
	THERMIT $8Al \div 3FeO_4$	INCENDIARY	None	5,000 degree heat ignites materials		None needed

AGENTS

PREPARED BY OFFICE OF CIVILIAN DEFENSE

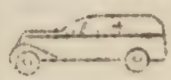
FIRST AID (After removal from gassed area)	PERSIS-TENCE	FIELD NEU-TRALIZATION
Undress; remove liquid mustard with protective ointment, bleach paste or kerosene; bathe; wash eyes and nose with soda solution.	One day to one week; Longer if dry or cold	Cover with unslaked lime and earth. 3% solution of Na_2SO_3.
Undress; remove liquid Lewisite with hydrogen peroxide, lye in glycerine, or kerosene; bathe; wash eyes and nose with soda. Rest - Doctor.	One day to one week. Longer if dry or cold	Wash down with water. Cover with earth. Alcohol. NaOH spray.
Undress; remove liquid with hydrogen peroxide, lye in glycerine, or kerosene; bathe; wash eyes and nose with soda. Rest - Doctor.	One hour.	Cover with earth, caustic.
Remove from gassed area. Keep quiet and warm. Coffee as stimulant.	10 minutes	Alkaline solution.
Wash eyes, keep quiet and warm. Do not use bandages.	Open 6 hours. Woods 12 hours.	$NaSO_3$-Sodium sulfite in alcohol solution.
Keep quiet and warm. Give coffee as stimulant.	30 minutes.	Alkali.
Keep quiet and warm, bed rest. Coffee as a stimulant. Loosen clothing. No alcohol or cigarettes.	10 to 30 minutes.	Alkali.
Wash eyes with cold water or boric acid solution. Do not bandage. Face wind. For skin, sodium sulphite solution.	10 minutes.	Strong, hot solution of sodium carbonate.
Wash eyes with boric acid. Do not bandage.	Several days. (Weeks in winter)	Alcoholic sodium hydroxide spray.
Keep quiet and warm. Loosen clothing. Reassure. Spray nose with neo-synephrin or sniff bleaching powder. Aspirin for headache.	10 minutes.	Bleaching powder solution.
Remove to pure air, keep quiet. Sniff chlorine from bleaching powder bottle.	Summer 10 minutes.	Bleaching powder solution.
Produces no effect requiring treatment.	While burning.	None needed.
Wash with soda solution.	5 to 10 minutes.	Alkaline solution.
Produces no effect requiring treatment.	10 minutes.	None needed.
Pack in cloths wet with copper sulphate (blue vitriol) or water or [illegible] in water [illegible] squeeze out particles. Treat for burn,	10 minutes.	Burns out.
Treat for severe burn.	5 minutes.	Quickly cover with earth or sand.

GENERAL INSTRUCTIONS

The importance of proper first aid for gas victims cannot be overemphasized. The following are general rules which apply in all cases.

A. Act promptly and quietly; be calm.
B. Put a gas mask on the patient if gas is still present or, if he has a mask on, check to see that his is properly adjusted. If a mask is not available, wet a handkerchief or other cloth and have him breathe through it.
C. Keep the patient at absolute rest; loosen clothing to facilitate breathing.

****** KEY ******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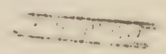
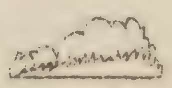

FIRST AID TREATMENT


SMOKE


INCENDIARY

****** ******

D. Remove the patient to a gas-free place as soon as possible.
E. Summon medical aid promptly; if possible, send the victim to a hospital.
F. Do not permit the patient to smoke, as this causes coughing and, hence, exertion.

MEDICAL ASPECTS AND FIRST AID TREATMENT OF GAS CASUALTIES

MEDICAL ASPECTS AND FIRST AID TREATMENT OF GAS CASUALTIES

I. LUNG IRRITANTS

A. Phosgene (CG)

1. Symptoms and Effects.

Delayed usually two hours, vary with concentration. Usually irritation of nose and throat with coughing, difficult breathing, pains in chest, later pulmonary edema.

2. First Aid Treatment

Remove the patient from gas atmosphere, if possible. Never remove gas mask until patient is removed from gas area. All patients gassed or suspected of being gassed with lung irritants should never be allowed to walk. Danger period - first 48 hours.
Loosen clothing, treat for shock, absolute rest and warmth, hot drinks (coffee, tea, cocoa, etc., no alcoholic drinks.)

In blue cases, bleed, give oxygen. In gray cases, don't bleed, give oxygen and heart stimulants. No artificial respiration. Evacuate in prone position.

B. Chlorpicrin (P.S.)

1. Symptoms and Effects

Similar to Phosgene but more irritant and lacrimating. More apt to produce nausea and vomiting. Pulmonary edema may follow. Less toxic than Phosgene.

2. First Aid Treatment.

Same as for Phosgene - in addition, wash splashes on skin with sodium carbonate or alcoholic sodium sulfite solution.

C. Chlorine (Cl)

1. Symptoms and Effects

Similar to Phosgene but more irritant to the lungs and less toxic. Coughing more pronounced than with Phosgene or Chlorpicrin. Pulmonary edema may follow.

2. First Aid Treatment

Same as for Phosgene.

D. Nitric Acid Vapors

1. Symptoms and Effects

Similar to Phosgene. Irritation to nose, throat and lungs, later pulmonary edema.

2. First Aid Treatment

Same as for Phosgene.

E. Ammonia

1. Symptoms and Effects

Prompt, marked irritation of eyes, nose, throat and lungs; effective concentration may cause temporary reflex stoppage of respiration. Bronchitis, laryngitis and pneumonia may follow.

2. First Aid Treatment.

Artificial respiration, inhalation of weak (acetic acid) vapor.

NOTE: Service gas mask canister does not protect against ammonia; special canister is necessary.

II. VESICANTS

A. Mustard (H.S.)

1. Symptoms and Effects - may be delayed - average time of development of symptoms is about four to eight hours.

a. EYES - the eyes are very liable to injury, whether from liquid or vapor. Though there may be some delay in appearance of signs, such delay is less than in other areas of the body. A few hours after exposure, inflammation (conjunctivitis) sets in with smarting, watering and rapidly gets worse, and there is much pain, especially on exposure to light (photophobia), with discharge coming from between the swollen lids. Actual destruction of the eye and consequent blindness is rare, but there may be some impairment of vision due to scars.

b. RESPIRATORY SYSTEM - inflammation of the throat and windpipe (trachea) as a result of breathing air contaminated by the vapor of these liquids is fairly common. It produces dry and burning mouth and throat, with harsh, ringing cough. This cough is very characteristic and very distressing. Partial loss of the voice due to inflammation of the throat (laryngitis) is common. In most severe cases burning of the lungs may produce pneumonia.

c. DIGESTIVE SYSTEM - Inflammation of the stomach, with pain and vomiting may occur. This is the result of swallowing contaminated saliva or the swallowing of contaminated food or drink. It is not serious as a fule.

d. SKIN - Injury to the skin develops in three states: reddening (erythema) with a fine rash not unlike "hives", blistering, and finally ulceration. How far the casualty progresses toward the final stage depends on the original concentration of the chemical agent and the length of the patient's exposure to the poison. In case of contamination by liquid, blistering always occurs if steps are not taken at once to counter-act the effects. The areas of skin most likely to suffer from exposures to vapor are those which are normally moist, such as the bend of the elbows and knees, the armpit (axilla), the crotch, and the inner side of the thighs. The genitals are particularly liable to attack.

2. First Aid Treatment

Removed from gassed area, remove contaminated clothing. If only portions of clothing splashed by liquid, cut those away.

a. EYES - irrigate immediately with 2% sodium bicarbonate solution or saturated boric acid solution, or normal saline solution. No cocaine, no covering except dark glasses.
b. RESPIRATORY SYSTEM - if gas is breathed, treat as lung irritant casualty.
c. DIGESTIVE SYSTEM - pain in stomach and vomiting can be temporarily relieved by warm sodium bicarbonate solution.
d. SKIN - if liquid, remove excess with cloth sponges. Wash with solution of dichloramine T. in triacetin; if not available, wash area with kerosene, alcohol, gasoline (without lead), carbon tetrachloride, or hot water and soap. Use bleach paste or weak solution of chloride of lime (bleach solution), using fresh cloth each time. After this, use hot water and soap - treat as ordinary heat burns. All contaminated clothing should be burned or buried.

B. Lewisite

1. Symptoms and Effects - more severe and more rapid than Mustard.
   a. EYES - if unprotected, eyes irritated immediately. Similar to Mustard.
   b. RESPIRATORY SYSTEM - if breathed, powerful lung effect in 1/2 hour. Bronchitis and pneumonia may result. Action similar to mustard.
   c. DIGESTIVE SYSTEM - action similar to Mustard.
   d. SKIN - shows slight irritation in 15 minutes followed by grayish discoloration and blistering in 30 minutes to one hour, later ulceration.
2. First Aid Treatment - must be immediate. Treat similar to Mustard.
   a. EYES - same treatment as for Mustard.
   b. RESPIRATORY SYSTEM - if gas is breathed, treat as lung irritant casualty.
   c. DIGESTIVE SYSTEM - same treatment as for Mustard.
   d. SKIN - if liquid, remove excess with cloth sponge, swab with hydrogen peroxide (3%). If not available, wash with 5% sodium hydroxide solution, then soap and water. If sodium hydroxide is not available, cleanse vapor burns with soap and water, cover this with ferric hydrate paste and gauze. Blisters should be opened and fluid must be prevented from contaminating other skin areas.

C. Ethyldichlorarsine (ED)

1. Symptoms and Effects

   Irritation, redness and burning of the skin; inflammation of eyes and eye lids; irritation of respiratory tract with marked sneezing.

2. First Aid Treatment

   General treatment same as for Lewisite.

III. LACRIMATORS

A. Tear Gas Solution (Chloracetophenone, Chlorpicrin, Chloroform) (CNS)

1. Symptoms and Effects

   Immediate tearing and pain and fear of the light, prickling or itching of the skin.

2. First Aid Treatment

   Face wind with eyes open; in more severe cases, wash eyes with 2% sodium bicarbonate or saturated boric acid solution. DO NOT RUB OR BANDAGE EYES. Persistent pain may be relieved by instilling 2% butyn sulfate. If necessary, skin may be washed with sodium bicarbonate solution.

B. Chloracetophenone (CN)

1. Symptoms and Effects

   Similar to CNS, with perhaps less action on the skin.

2. First Aid Treatment

   Same as for Tear Gas Solution.

C. Brombenzylcyanide (CA)

1. Symptoms and Effects

   Severe tearing and nasal irritation.

2. First Aid Treatment

   Same as for Tear Gas Solution.

IV. STERNUTATORS (Toxic Smokes)

A. Diphenylaminechlorarsine (Adamsite) (DM)

1. Symptoms and Effects

   Sneezing, with burning, aching pains in nose, throat, chest, sinuses, followed by headache, sinus pains, nausea and often mental depression.

2. First Aid Treatment

   Inhale chlorine fumes through nose and mouth from bleach bottle; acetylsalicylic acid may be taken orally to relieve pain. Physical restraint may be necessary to prevent self-injury.

B. Diphenylchlorarsine (DA)

1. Symptoms and Effects

   Same as for Adamsite (DM)

2. First Aid Treatment

   Same as for Adamsite (DM)

V. SYSTEMIC POISONS

A. Hydrocyanic Acid (HCN); Prussic Acid.

1. Symptoms and Effects

Low concentration of vapor may cause giddiness or headache; effective vapor concentrations or the liquid rapidly produces convulsions, unconsciousness, or death from tissue asphyxia or medullary paralysis.

2. First Aid Treatment

Inhale amyl nitrite. Give artificial respiration if necessary. Sodium nitrite, sodium thiosulfite, or methylene blue should be given intravenously.

B. Arsine (AsH_3)

1. Symptoms and Effects

Shivering, weakness, giddiness, nausea, vomiting, headache, gray color, collapse; hemolysis, anemia, anuria, uremia.

2. First Aid Treatment

Absolute rest; evacuate in prone position. Ferric hydroxide or arsenic antidote by mouth may be tried. Give large amounts of fluid, blood transfusions, and try to promote diuresis.

C. Hydrogen Sulfide (H_2S)

1. Symptoms and Effects

Irritation of eyes, nose, respiratory tract; bronchitis; high concentrations cause unconsciousness and death.

2. First Aid Treatment

Absolute rest; artificial. Give oxygen-carbon dioxide and blood transfusions.

D. Carbon Monoxide (CO)

1. Symptoms and Effects

Dizziness, headache, weakness, nausea and vomiting, feeling of constriction in thorax, followed by drowsiness, visual disturbances, stupor, unconsciousness, weakened pulse and respiration, and death.

2. First Aid Treatment

Artificial respiration, administration of oxygen or oxygen-carbon dioxide; venesection with transfusion of healthy blood may be valuable.

VI. INCENDIARIES

A. White Phosphorus (WP)

1. Symptoms and Effects

Severe burns depending on size of articles and length of contact.

2. First Aid Treatment

Cover burning surfaces with water or preferably 5% copper sulfate solution, and remove phosphorus particles with forceps. Further treatment same as for ordinary burns.

B. Thermit (TH)

1. Symptoms and Effects

   Same as with white phosphorus.

2. First Aid Treatment

   Spray burning areas with water, and remove pieces of material. Further treatment, same as for ordinary burns.

C. Electron Bomb - (The electron bomb is a magnesium case filled with fast burning thermit. The thermit sets fire to the magnesium case which is the effective incendiary material in this bomb. Electron bombs are being widely used in the present European conflict)

1. Symptoms and Effects

   More severe penetrating burns than with white phosphorus or thermit, as it continues to burn in tissues in presence of moisture.

2. First Aid Treatment

   Remove burning material. Treatment of injuries that of ordinary burns.

MEDICAL SERVICE IN THE FIELD

Pages 1-2 missing

b. Procuring litter, command: 1. Procure litter, 2. Right (left) FACE, 3. MARCH. (Number threes are marched to the litter stack, procure litters and return to places in rank).

6. Demonstration. Brief remarks by the instructor concerning the position of the canvas when the litter is on the shoulder, and the position of the litter to and from the shoulder. The demonstration litter squads now demonstrate.

a. Being at the shoulder, to order litter. Command: 1. Order, 2. LITTER.
b. Being at the order, to shoulder litter. Command: 1. Shoulder, 2. LITTER.
c. Carrying of the empty litter. Command: 1. Carry. 2. LITTER.
d. Grounding of the empty litter. Command: 1. Ground, 2. LITTER.
e. Being at the ground, to carry litter. Command: 1. Carry, 2. LITTER.

7. Demonstration. The demonstration litter squads demonstrate:
a. Changing of bearers. Command: 1. Change bearers, 2. MARCH.
b. Being at the carry, to shoulder litter. Command: 1. Shoulder, 2. LITTER.

8. Demonstration. The instructor makes pertinent remarks concerning the opening of the litter. The demonstration litter squads demonstrate:
a. Being at the carry to open the litter. Command: 1. Open, 2. LITTER.
b. To secure slings the litter being lowered. Command: 1. Secure, 2. SLINGS.
c. Being at the open, to close litter. Command: 1. Close, 2. LITTER.
d. The litter being closed, to strap litter. Command: 1. Strap, 2. LITTER.
e. Bringing squad into line, the litter being on the ground, open. Command: 1. Form, 2. RANK.
f. Returning to positions at litter posts. Command: 1. Litter, 2. POSTS.

9. Demonstration. The instructor makes pertinent remarks concerning drill with the loaded litter, including positions of the bearers. The demonstration litter squads demonstrate:
a. Loading and unloading the litter, the litter being at the open. Command: 1. Right (left) side, 2. POSTS.
b. Lifting patient upon the litter, Command: 1. Lift, 2. PATIENT.
c. Lowering patient upon the litter. Command: 1. Lower, 2. PATIENT.
d. The above commands: a., b., and c., with three bearers, with two bearers, and alternative method of handling patient with two bearers are demonstrated.

10. Demonstration. The instructor makes pertinent remarks on the passing of obstacles. The demonstration litter squads demonstrate:

a. Surmounting obstacle with litter. Command: 1. Obstacle, 2. MARCH.

b. Crossing narrow cut or ditch.

c. Crossing wide cut or ditch.

d. Crossing running stream or rough ground.

e. Carrying loaded litter upstairs. Command: 1. Prepare for stairs. 2. MARCH.

f. Carrying loaded litter downstairs. Command: 1. Prepare for stairs, 2. MARCH.

11. Demonstration. The instructor makes pertinent remarks concerning the manual transport for sick and wounded (FM 8-35, Chap. 2).

a. One bearer demonstrates the fireman's carry.

b. One bearer demonstrates the saddle-back carry.

c. One bearer demonstrates the arms carry.

d. Two bearers demonstrate the saddle-back carry. Command: 1. Head and feet, 2. POSTS; 1. By saddle-back carry, 2. Lift, 3. PATIENT.

e. Two bearers demonstrate the supporting carry. Command: 1. Both sides, 2. POSTS; 1. By supporting carry, 2. Lift, 3. PATIENT.

12. Students are given an opportunity to ask questions at the end of each phase of the demonstration. Any phase or a part of any phase may be redemonstrated if desired. This concludes the demonstration.

13. Student application. At the termination of the demonstration, the class is divided into two or more platoons, each platoon under the immediate supervision of an instructor (see Plate No. II). All commands and movements are executed by student litter squads. The demonstration troops are used as assistant instructors. Acting patients are provided by the demonstration troops, one patient for each student litter squad.

14. Plan.

a. The demonstration troops are formed as shown in Figure No. 1.

b. The students are formed to observe the demonstration.

c. The instructor outlines the purpose of this period of instruction, and describes the ambulance and its use in field and garrison. He emphasizes that properly executed ambulance loading and unloading is essential to insure maximum comfort to the patient.

d. The assistant noncommissioned officer instructor forms his litter squad for ambulance loading and has the squad demonstrate as shown in 10 e. 1. and 2. He carefully explains each step before the litter squad demonstrates it.

e. The demonstration troops proceed as follows:

(1) Ambulance loading, motor.

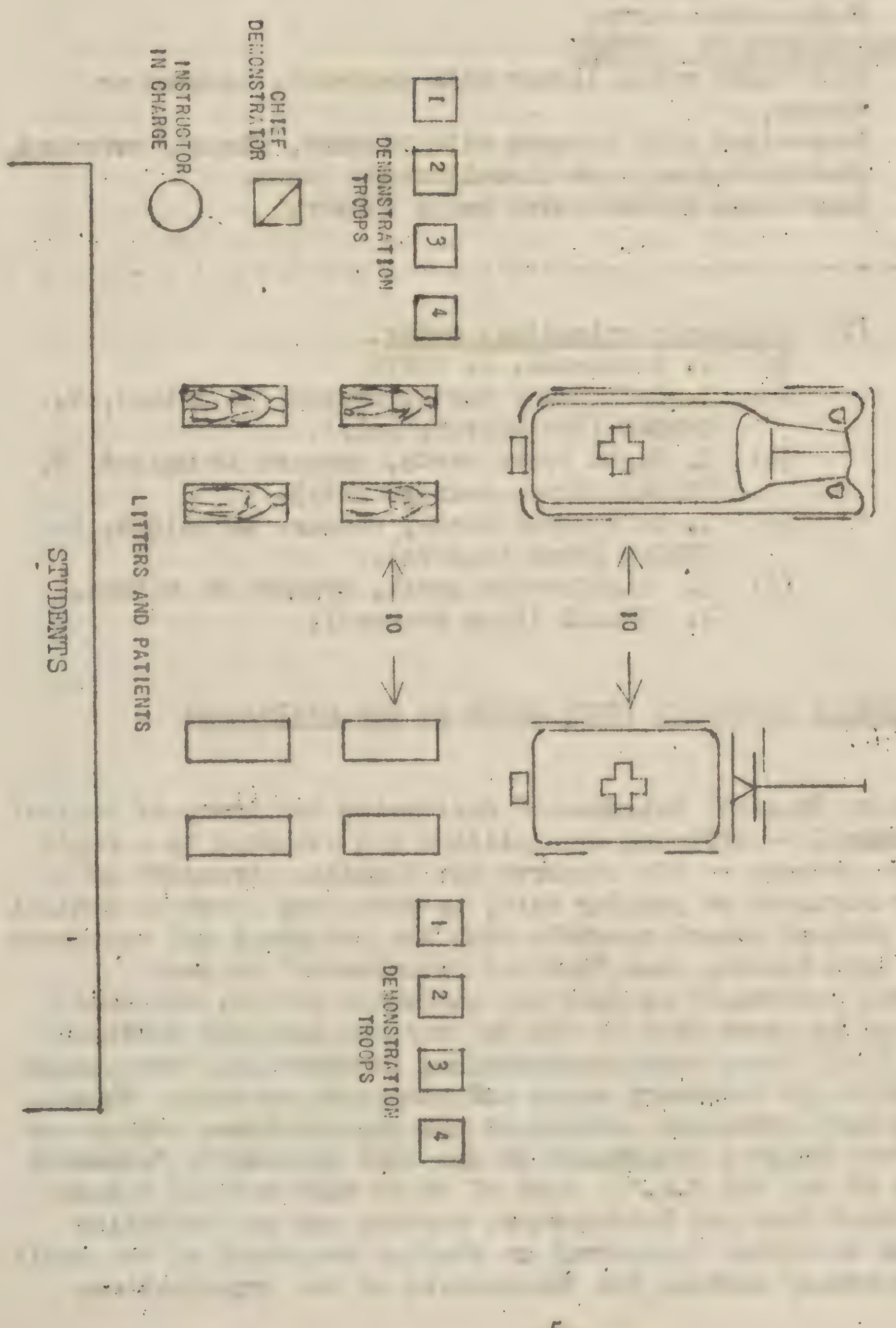
(a) 1. Ambulance, 2. POSTS.

(b) 1. Right upper berth, prepare to load, 2. LOAD.

(c) 1. Left upper berth, prepare to load, 2. LOAD.

(d) 1. Right lower berth, prepare to load, 2. LOAD (three bearers only).

(e) 1. Left lower berth, prepare to load, 2. LOAD (two bearers only).



FORMATION FOR DEMONSTRATION AMBULANCE LOADING

1. TYPES OF LITTERS
   a. Hand litter
      (1) Wood
      (2) Aluminum
2. IMPORTANCE OF LITTER IN RELATION TO CASUALTIES - WHEN LITTER IS USED. The litter is used to transport casualties from the field to the aid stations, and from the aid stations to the collecting stations.
3. TYPES OF CARRIES WHEN LITTERS NOT AVAILABLE
   a. Supporting carry.
   b. Arm carry.
   c. Saddle back carry.
   d. Fireman's carry.
   e. Pack-saddle carry.
4. IMPROVISIONS OF LITTERS.
   a. Improvised rifle litter with overcoat, blanket or blouse.
   b. Improvised pole litters with blanket, blouse, overcoat, shelter-halves, and miscellaneous items.
   c. Improvised forked-stick horse litter.

- -

(2) Ambulance unloading, motor.
   (a) 1. Ambulance, 2. POSTS
   (b) 1. Left lower berth, prepare to unload, 2. UNLOAD (Two bearers only).
   (c) 1. Right lower berth, prepare to unload, 2. UNLOAD (three bearers only).
   (d) 1. Left upper berth, prepare to unload, 2. UNLOAD (Four bearers).
   (e) 1. Right upper berth, prepare to unload, 2. UNLOAD (four bearers).

ATTACHED MEDICAL PERSONNEL (WITH UNITS OF THE DIVISIONS)

The term "Medical Detachment" designates the group of Medical Department personnel -- officers and enlisted men attached to a regiment for the one purpose -- "To conserve the fighting trength" of that particular regiment or similar unit, by rendering adequate medical service to the fullest extent possible with the personnel and equipment provided. For this reason, such "Medical Detachments" or such "attached medical personnel" as they are sometimes called, are permanently attached to every unit of all the various Arms and Services and accompany at all times such organizations to which they are assigned -- in the field, in temporary camps and permanent station. These medical units become permanent members of the organizations and are so designated -- "the Medical Detachment of the 23rd Infantry", "Attached Medical Section of the 9th F.A.". Each of these unit medical detachments are organized into one headquarters section and one battalion section for each battalion (squadron) or similar component of the regiment, and a veterinary section for the animals of the organization.

The headquarters section of the medical detachment provides for the interior economy of the medical detachment (administration, supply, communications, pay, mess, reports and records, etc.) for its several battalion sections, in the same way that a Company Headquarters section provides for the administration of its own organization. Note this exception, however, that in the field or temporary camps the medical detachment normally messes with the organization to which attached: the "detachment headquarters section" messes with headquarters company of the regiment, and each "battalion or squadron medical section", (less the aid men) messes within the battalion or squadron to which attached, while the company aid men (battery, troop) mess with company with which they are serving. The headquarters section serves as a small reserve with which the regimental surgeon may reinforce any of the battalion medical sections or replace one of them altogether if it were destroyed or its battalion were to move forward leaving a large number of casualties which would otherwise immobilize the battalion medical section. The headquarters medical section may also establish a regimental aid station for casualties in the vicinity of the regimental command post. Normally, the headquarters section of the regimental medical detachment and the regimental aid station set up by it are not links in the chain of evacuation from the regiment. The divisional collecting station is established in an area of security as close as possible to the several battalion aid stations to evacuate them and the regimental aid station, all separately.

A battalion medical section provides medical service for a battalion at such times as it is impracticable to operate the medical service for the regiment as a unit -- the customary "regimental medical dispensary" of permanent station. It consists of the battalion surgeon, his assistant surgeon and enlisted personnel generally about twice the strength of the headquarters section. The battalion section comprises three groups, the aid station group -- 2 medical officers and 7 enlisted men, the company aid group of 2 enlisted men per each company of the battalion, and a litter bearer group of one or more litter squads. In the interest of efficiency a battalion section should be allocated habitually to the same battalion, but situations may arise in which exceptions to this rule are indicated. When in the presence of the enemy and when battalions are separated from their regiment, battalion medical sections are attached to their respective battalions. Such an attachment should be considered as of a temporary nature even though it endures indefinitely.

(Aid Station Group) of enlisted men consists of a sergeant in charge, and who is a surgical assistant and dresser, responsible for property, water purifications, etc. A corporal is generally assistant dresser and responsible for sterilization of instruments and gives hypodermic medication. One private first class is assigned to clerical duties, while 4 more privates are chauffeurs of the aid station trucks and can be used for general utility purposes as required. The aid station will receive and record casualties of the battalion, examine

and treat the sick and wounded, administer antitetanic serum, narcotics, hot drinks and food, provide temporary shelter and "completely tag (EMT)" all casualties before transferring them to collecting company personnel of the division.

(Litter Bearer Group) consists generally of 12 privates who work in 3 squads within the zone of action of their battalion. They locate casualties, give first aid dressings to permit evacuation by litter, tag casualties (EMT) missed by the company aid men, remove all seriously wounded from the field to the aid station and direct and assist walking wounded to the aid station. They may bring forward and apply leg or arm splints to fracture cases previously located.

(Company Aid Group) consists of enlisted men who follow their respective companies (battery, troop) into battle, administering immediate first-aid treatment. They tag the sick, wounded and dead, they direct the walking wounded to the aid station, indicating the shortest and safest routes thereto. They facilitate the work of the litter bearer groups by marking the location of seriously wounded, moving them to sheltered locations, if possible. The company aid men send useful information to the battalion surgeons relative to the tactical situation near the front by messages carried by the litter bearers or walking wounded.

A Veterinary Section is provided for those battalions and squadrons having animals. Personnel and equipment are organized for treatment and evacuation similar to battalion medical section.

EMPLOYMENT OF THE ATTACHED MEDICAL PERSONNEL WITH INFANTRY

(In Garrison) the principal functions of the regimental medical detachment are: training in sanitary inspections, operation of dispensaries and station hospital. Regiments ordered from the field to garrison will ordinarily be accompanied by their medical detachments. In large garrisons, personnel from the regimental medical detachments are assigned for duty at the station hospital as needed to meet the added hospitalization requirements. In a permanent station or camp, sanitary procedure will generally modify or adapt the environment to the needs of the troops, rather than apply temporary or expedient measures to the troops themselves as must be done for the protection of their health while in the field. The duties of the medical detachment in connection with sanitation are inspectorial and advisory -- the QMC provides both the labor and supplies for all sanitary procedure. In addition to training, which is peculair to the medical department, the medical detachment participates in first aid training of the troops of the command, in practice marches, maneuvers and other training of the combat force which it serves.

(On the March) the medical detachment concerns itself with the care and evacuation of march casualties. Prior to the march the regimental surgeon obtains from the regimental commander information regarding the day's march and passes on to his subordinates pertinent information for their guidance. He inspects the detachment for its own preparedness for participation in the march, paying particular attention to the condition of men, animals, transportation and equipment. During the march medical officers care for and make disposition of march casualties -- relieve the soldier of his pack and recommend continuing the march, or put in an ambulance or other transportation for disposition at the end of the march, or keep him at the tail of the column for medical observation, or to be left at a march collecting post along the roadside. All casualties separated from their organizations are plainly tagged with the EMT by a member of the medical department. All arms and personal equipment of sick or disabled dismounted soldiers remain with them. March casualties among mounted troops of the cavalry, artillery, etc., may be directed to follow the command or be sent back to some place where medical attention is available. It may be necessary in emergencies to leave them with friendly inhabitants or under shelter to be picked up and evacuate to the rear by supporting medical troops. The mounts saddle equipment and arms of wounded soldiers unable to continue the march are returned to their organizations.

(Medical Department Disposition During the March) is governed by the commander's march orders. The regimental surgeon usually marches with that part of the staff which accompanies the regimental commander, since he is a member of that staff, as well as, commanding officer of the regimental medical detachment. The assistant regimental surgeon and the dental officers march with the headquarters medical section generally located with the regimental train. Battalion and squadron surgeons march with the party which accompanies the battalion or squadron commander -- being part of the staff of such commanders. Assistant battalion or squadron surgeons and dental officers when attached march at the rear of the battalion with their respective battalion or squadron medical section. Trucks carrying the equipment of the battalion or squadron sections are a constituent part of the battalion or squadron train; in like manner the trucks of the "headquarters regimental medical detachment" are a constituent part of the train of the headquarters company (battery, troop). When operations are imminent or march conditions cease, these trucks are released to the battalion, squadron or regimental surgeon as the case may be. Ambulances attached to a regiment of dismounted troops for the collection and evacuation of march casualties will ordinarily be furnished from the medical regiments or medical battalions of the division concerned. Ambulances and personnel so detailed are under the immediate control of the regimental surgeon in each unit for the duration of the march. When march conditions cease these ambulances revert to the control of their organization (collecting company of the medical regiment or medical battalion of the division). If but one ambulance is assigned to the regiment, it follows

the headquarters regimental medical detachment at the rear of the column. If additional ambulances accompany the column, they may be marched with the various battalion medical sections. Ambulances organically assigned to cavalry, field artillery (or other such units widely dispersed in combat and therefore equipped with their own ambulances for evacuating casualties from their aid station to the division clearing station), are similarly disposed during the march with their respective battalion medical sections, and after march conditions cease, such ambulances remain with their organizations.

(Upon Arrival in Camp or Bivouac) the medical detachment camps or bivouacs in accordance with its march disposition and may establish battalion squadron and regimental dispensaries. Only such equipment is unpacked as is necessary to permit them to function; sick call is conducted daily in dispensaries usually on arrival in camp and again previous to breaking camp. Except when acting alone, the regimental medical detachment has no responsibilities for the evacuation of casualties. March casualties are disposed of at halts by return to duty, by delivery to ambulance units or by dispatch to the rear on returning empty supply transportation. Ambulances transporting patients make mutual exchange with medical installations from which they receive or to which they deliver them, of blankets, litter and splints accompanying the patient.

GENERAL EMPLOYMENT IN COMBAT

The principles herein set forth govern the tactical management of all medical detachments serving with combat troops. The tactics employed by the combat units constitute the determining factor in the disposition to be made of attached medical personnel. For the efficient execution of medical service in the field, all medical officers should make a reconnaissance of the area to be occupied by the organizations served, including the terrain to the immediate front, as well as, to the rear of their area so that they can prepare plans for the collection, treatment and evacuating of the sick and wounded in the event of a change in situation.

What to look for	Why
General character of the country	Orientation
High ground	For observation and shelter
Road net	Evacuation routes to the rear
Ravines, stream bed, trails	Natural lines of drift of wounded
Cover: Brush, Woods, Ravines, Stream lines	Shelter from observation and from fire and for water source.

<u>Estimate of the Situation</u>

1. Mission - the governing element in every plan, assigned from higher authority.
2. Situation - analysis of the elements involved.
   (1) Enemy capabilities - strength, position, weapons, air action, etc.
   (2) Own situation -
      (a) Battle plans of the commander.
      (b) Strength.
      (c) Position - from the point of view of casualty expectation.
      (d) Movement - of the entire force or any major component.
      (e) Other factors that may influence own situation, physical condition, morale, training, experience, leadership of own troops.
   (3) Physical factors.
      (a) Ground features - influence upon casualty rate, collection or evacuation.
      (b) Availability of roads, etc. (from higher authority).
      (c) Weather - day or night, humidity vs. gas casualties, etc.
      (d) Other factors, fortifications, etc.
3. Estimation of Casualties - <u>numbers</u> and probably distribution, "areas of casualty density", (16-20% of all casualties are killed or die on the field, of the others 50% are litter patients, 50% are walking wounded). Estimate will consider that:
   (1) Battle casualties are not ordinarily equally distributed along the front.
   (2) Casualties in certain battalions and companies will be <u>greater</u> than in the regiment as a whole.
   (3) Attacking troops usually have greater casualties than defending troops.
   (4) In the attack the greatest casualties will occur in units having the more difficult missions (main attack).
   (5) In the defense, the greatest casualties will occur in units holding the strategic points.
   (6) Heavy casualties usually occur at stream crossings, road crossing, road and railway junctions, and in all locations which permit enemy observation.
4. Available Medical Means.
   (1) The Medical Units normally assigned - current status, and capabilities for further effort, strength, physical condition, training and equipment in relation to the task.
   (2) Additional medical units attached from the <u>division</u> for for the effort at hand.
   (3) Medical support - evacuation and other medical support by larger medical units to the rear, and not under control of own unit.

(4) Supply - medical supplies on hand, and facilities for their replenishment.

5. Plans - all possible plans and analyses of their several merits.
6. Decisions - a statement in concise terms of the <u>best</u> medical plan.

The best medical plan for the regimental medical detachment will render medical service by:

(1) Tagging and sorting the disabled - EMT
(2) Establish aid stations, collect and treat casualties thereat.
(3) Prevent unnecessary movement to the rear of minor casualties (treat and return to duty).
(4) Aid in the preservation of morale by early medical attention and prompt removal of the wounded.
(5) Tagging of the dead and sanitary supervision of their disposal - EMT
(6) Prepare records of the dead and wounded - EMT, plus aid station summaries.

<u>Aid Stations are Established</u>

1. When in combat number of casualties present or expected justify such action.
2. Only such part of the aid station is established as immediate or near future circumstances may require.
3. Aid station keep in contact with the units they serve at all times (by litter bearer squads, walking wounded, company aid men).
4. Treatment given at aid stations should be such as will promptly return men to duty or expedite their evacuation to the rear. The aid station is not a proper place for the initiation of elaborate treatment of surgical cases.
5. Blankets, litters and splints evacuated with patients must be replaced by exchange with the next medical echelon to the rear (collecting company litter bearers bring forward such supplies for exchange).

<u>Aid Station Sites</u> - are generally located at the rear center of the unit served, from 200-800 yards from the front line. In the selecting of actual aid station sites the following features should be kept in mind:

<u>Desirable</u>	<u>Undesirable</u>
1. Protection by cover and defilade from direct enemy observation and fire.	1. Possible direct enemy observation and fire.
2. Short litter carry	
3. Proximity to natural lines of drift of the walking wounded.	

Desirable	Undesirable
4. Ease of contact with troops served. 5. Ease of communications with the rear 6. Ease of advancement of station to front or rear. 7. Access to water source. 8. Protection from the elements.	2. Sites in close proximity to likely hostile targets such as bridges, fords, crossroads, ammunition dumps and artillery positions.

In The Attack Situations - conditions usually permit the medical detachments to make complete plans for the medical service. The regimental commander's plan of action for the attack should be carefully studied, coordination secured with the troops to be served, and detailed plans covering all phases of the medical detachment's participation in the action carefully formulated. The necessary orders may then be issued. In many situations the headquarters section will be held in reserve to reinforce the battalion sections as becomes necessary, or instead the headquarters section may set early and care for casualties of the entire regiment, permitting the battalion sections to remain packed and loaded so as to move up forward with their battalions as far as possible before unloading, thereby making litter carry as short as possible. Battalion surgeons will request from the regimental surgeon such additional medical equipment and personnel as becomes necessary; similarly the regimental surgeon will secure reinforcements from the division surgeon when the need arises or can be foreseen. In emergency a surgeon will request the assignment of additional personnel (including prisoners of war) from the unit being served to assist the litter bearer squads.

INFANTRY FORMATION	"ATTACK"	BATTALION MEDICAL SECTION FORMATION
Zone of Battalion advance in column of squads	1st Phase	Company aid men with companies to which attached. Aid station squad, litter bearer squad, and truck follow in rear of Battalion.
Zone of advance, approach march, by section columns, casual shelling	2nd Phase	Company aid men as in the 1st phase; Battalion medical sections less the company aid men follow the battalion infantry reserve. Aid station material is carried by truck or hand.

INFANTRY FORMATION	"ATTACK"	BATTALION MEDICAL SECTION FORMATION
Zone of advance by squad columns heavier shelling, and long range machine gunning, occasional skirmish line	3rd Phase	Company aid men follow closely their companies, Battalion surgeon making local reconnaissance, aid station squad is in readiness: litter bearers follow axis of advance and begin evacuation.
Zone of advance in attack formation, heavy fire of all kinds, usually skirmish line	4th Phase	Company aid men follow into the assault, aid station in reserve or unpacking as required, litter bearers as in 3rd phase.
Assault	5th Phase	Company aid men held up temporarily on the forward line of 4th phase. Aid station and litter bearers as in 3rd and 4th.
Organization of the position temporary defensive and security formations	6th Phase	Company aid men join companies to which attached and carry on, litter bearers clear field of wounded, aid station section prepare to move forward.
Reorganization of the companies approach or attack formations	7th Phase	Company aid men as in 6th, litter bearers complete evacuation, aid station moving forward to keep closer contact.
Pursuit	8th Phase	Company aid men with companies attached, litter bearers follow axis of advance, and begin evacuation, aid station caring for recent wounded, remaining partially set up or in readiness for moving up again.

IN THE DEFENSE of a position, there is usually sufficient time for a systematic reconnaissance of the entire area occupied by the regiment, and for the preparation of unit plans. All disposition should be made in such a manner as to give adequate medical service and permit of relief for the personnel. The positions occupied are progressively improved - the aid stations are fully established in the best obtainable sites, with shelter from enemy fire, observation and from the weather.

IN RETROGRADE MOVEMENTS from a position, contact with the enemy is to be broken. The units in contact with the enemy are withdrawn and positions are selected from which to cover the withdrawal and delay hostile pursuit. A position well to the rear is designated to which units will be withdrawn, assemble and reorganize for its future employment. If already established at the beginning of a withdrawal the headquarters section, regimental medical detachment may become a very important link in the chain of evacuation of casualties, by leap-frogging its regimental aid station with the various battalion aid stations, making every effort to keep all aid stations evacuated and mobile, with organic transportation close at hand. A battalion medical section may be divided for example: a battalion is employed to cover a wide area as delaying force. In a withdrawal the movement is rapid, no attempt is made to establish aid stations, but collecting points should be designated along the battalion axis of withdrawal. The aid station squads of battalion medical sections as well as the head-quarters section occupy such points along the axis and provide emergency treatment for as many casualties as possible. As organizations in contact with the enemy withdraw and pass these points in their withdrawal the position is vacated and the aid station squad proceeds to the next designated collecting point in the rear, taking with them as many seriously wounded as possible. Speed of evacuation by available means is the predominant indication, charging the divisional collecting company concerned with maintaining close contact with the several aid stations and collecting points established by these sections of the regimental medical detachment.

EMPLOYMENT WITH UNITS OTHER THAN INFANTRY

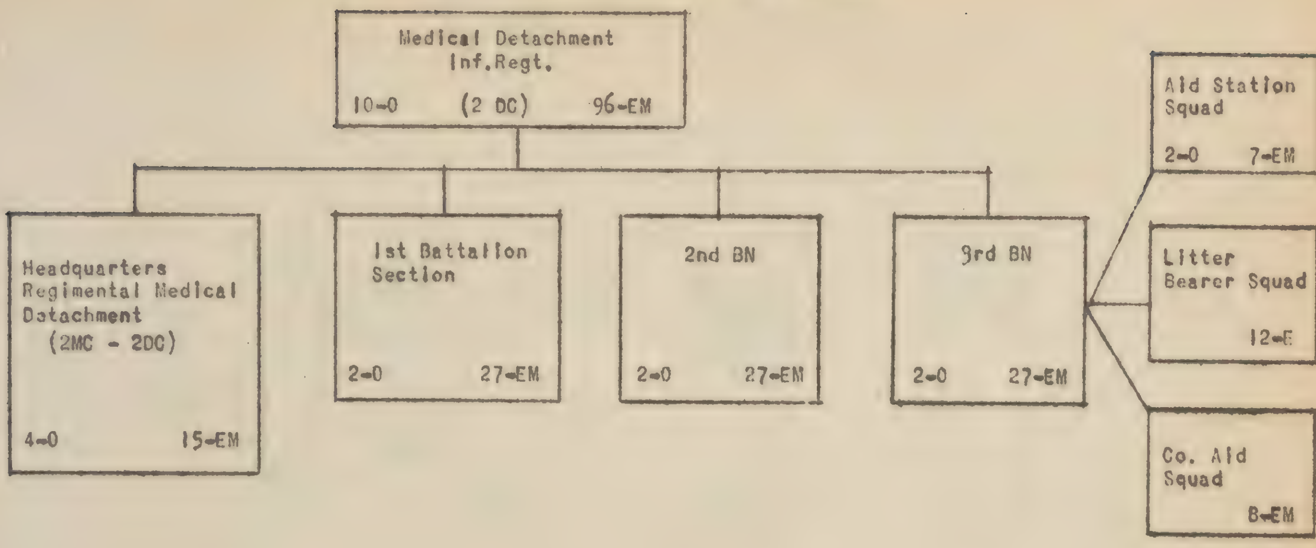
With Artillery the medical detachment is government by principles similar to those for infantry. The detachment is divided into a headquarters section, 2 or 3 battalion sections, and in some regiments veterinary section. In garrison, on the march, or in semi-permanent camp the medical service is the same as for regiments of infantry. In combat again general rules are approximately the same -- aid stations should never be established near battery positions, ammunition dumps, or in close proximity to the parking place for artillery caissons. They may be established near roadways, but not close to road inter-sections and crossroads. A road leading to or from the immediate vicinity of the aid station is highly desirable, since this facilitates evacuation by ambulance, because regimental medical detachments with field artillery are provided with their own ambulances which are assigned

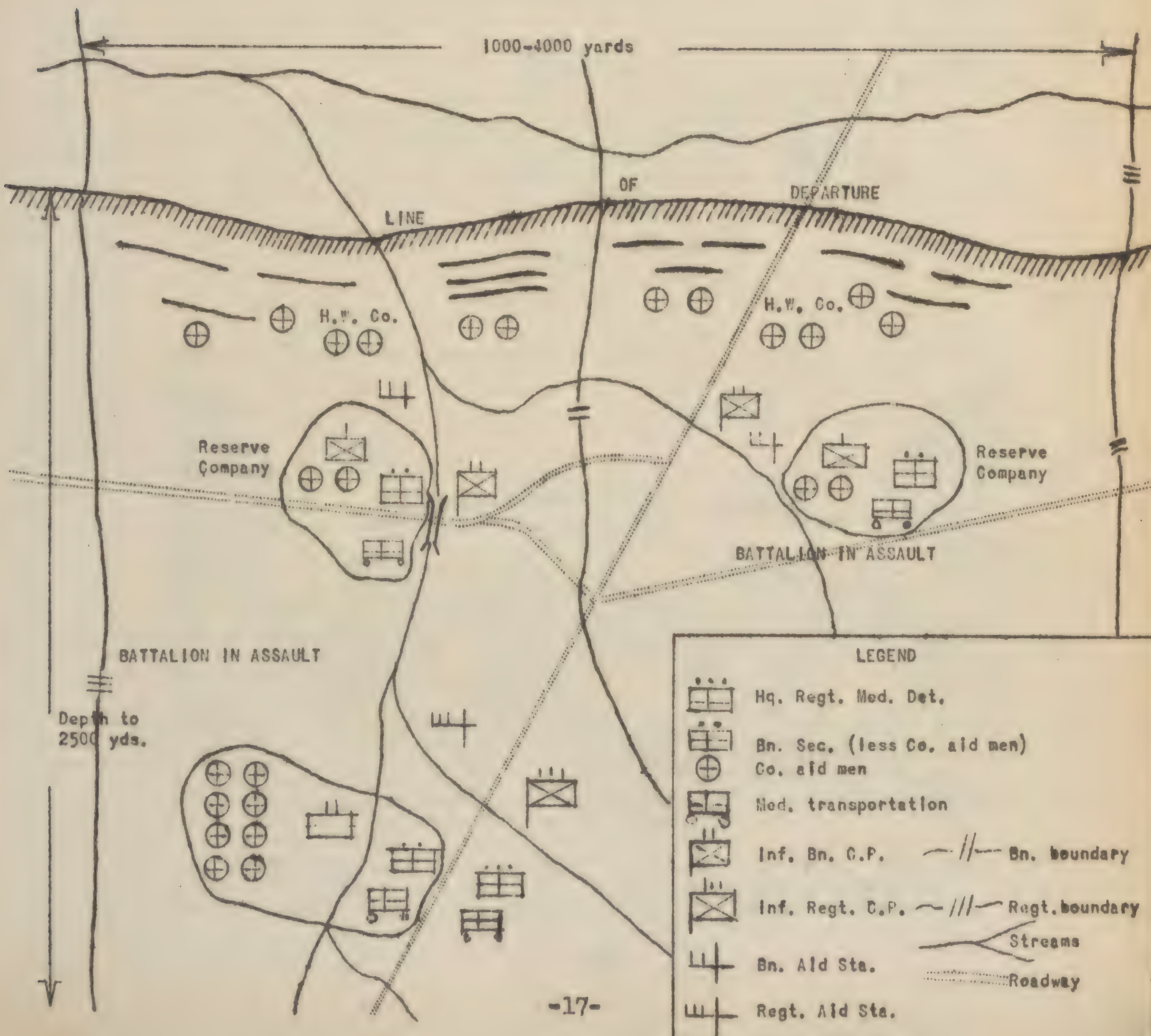
to each battalion medical section in combat so they can evacuate their own casualties to the divisional collecting station. This is so done because the battle-day casualty rate for a regiment of artillery is usually lower than the rate for infantry; casualties are not directly related to tactical considerations and because regimental artillery positions are generally located at some distance from and to the rear of the divisional collecting station, hence not suitable for evacuation by divisional collecting company litter bearers. More time and attention can be given to cases at each aid station and ambulance evacuation aid station or battery position.

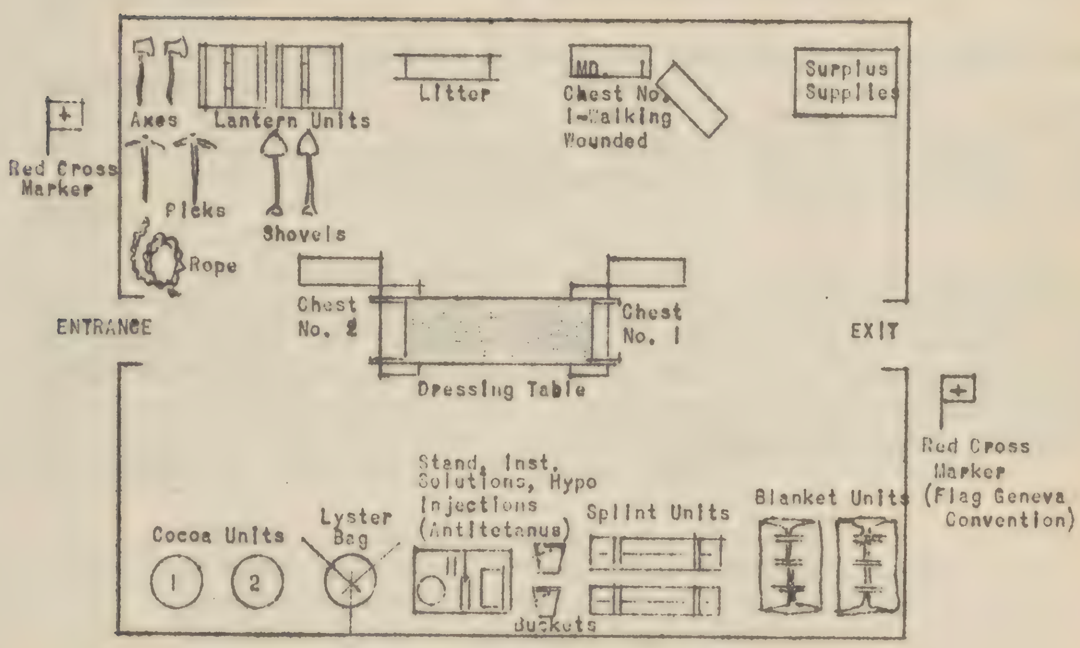
With Cavalry the regimental medical detachment is divided into a headquarters medical section, 3 squadron medical sections and a regimental veterinary station. In garrisons on the march or in temporary camp the medical service rendered is the same as for regiments of infantry. In combat, cavalry emphasizes the maneuver aspect of tactics (fighting both mounted and dismounted) so Medical Service to be effective must remain mobile in order to accompany the unit served. When the squadron deploys for action, the squadron medical section and such personnel as may be attached take up a position with or near the squadron reserve. Aid stations should never be fully established during periods of continued and rapid movement of troops nor when the dispersion of troops is such that any given aid station can serve no more than one troop, situations which are not unusual in the service of the cavalry. Casualties unable to walk are removed to the position of the aid station squad by the use of their own mounts, the travois, the field ambulance or the regimental medical detachment, or by requisitioned wheeled transportation. Casualties unable to endure transportation are left with medical material and with or without medical attendants in the care of civilian inhabitants.

With Mechanized Units lines of communication may be temporarily interrupted. Maneuver is the rule, both during combat and for security. Such forces may rarely remain with safety in one location in the presence of the enemy for any appreciable time. Combat is preceded and followed by movement. The personnel for the most part fight in armored vehicles and their tactics are almost invariably offensive. The organization and employment of the medical detachments of mechanized units reflect these characteristics in directing the principal effort at first aid, either in the vehicles themselves or on the field, and carrying the casualties in combat or other vehicles until they can be evacuated. No litter squads are provided, aid stations when established, are in the nature of collecting points to which casualties are brought either in the combat vehicles or the troops themselves or the motor ambulances; which are an organic part of the equipment of these medical detachments.

MEDICAL SERVICE IN THE FIELD







Conventional floor plan of an Aid Station.

An Aid Station in operation.

(1) Litter bearer squad. (2) Receiving. (3) Records (4) Water. (5) Dressing table. (6) Instruments and solutions (7) Dressing stand for treatment, walking wounded. (8) Surplus supplies. (9) Litters, splints and blankets.

THE MEDICAL REGIMENT, BATTALION AND SQUADRON

The Medical Regiment, Battalion and Squadron represent organic medical unit designed to "Conserve the fighting strength" of divisions, corps and army, by:

Prompt evacuation of sick and wounded from all subordinate units being served.

Care of these sick and wounded until they can be returned to duty or evacuated to other medical installations to the rear.

Providing medical supplies for all subordinate units being served.

The essential elements which are required for this work consist of litter bearer groups, ambulance teams, hospitalization or "clearing" units, the medical supply or depot service, as well as the usual internal organization similar to that of any comparable "line battalion", regiment, etc. The proportions of these various elements vary in such a way that these medical organizations can be adapted to the particular units they will serve, thus:

Medical regiment - - Square Division
Medical battalion - Triangular Division
Medical squadron - Triangular Division
Medical regiment and battalion - - Corps and Army

The Medical Regiment is a large medical organization intended for the support of the large "square" infantry division, the corps and the army. Accordingly it consists of:

Collecting battalion (three collecting companies - litter bearers)
Ambulance battalion (three ambulance companies)
Clearing battalion (three clearing companies - hospital tents, etc.)
Headquarters and service company (medical supply depot and service)

The Medical Battalion is a streamlined medical organization intended for the support of the modern "triangular" infantry division, and also the corps and army. It is comparable to the medical regiment in all essentials, but it is completely concentrated, with fewer personnel, and less "red tape" involved in the execution of routine procedures, in order to maintain closer contact with the units of the division served. Thus:

Collecting company (3), (litter bearers and ambulances)
Clearing company (1), (hospital equipment)
Headquarters and service detachment (medical supply depot and service)
Headquarters (commanding officer, etc.).

The Medical Squadron is a medical organization intended for the support of the cavalry division, consisting of:

Collecting troop (1), (litter bearers and ambulances)
Clearing troop (1), (hospital equipment)
Veterinary troop (animal evacuation and treatment)
Headquarters detachment (medical supply depot and service)
Headquarters (commanding officer, etc.)

The medical service behind the division areas involves again the doctrine that the higher echelon (larger organization to the rear) must always assume responsibility for evacuation of the casualties, of men and animals from its principal subordinate units. Stated in other words, this means that medical service is principally concerned with casualties in its own forward areas, while other organizations further to the rear perform the next steps in evacuation. For the evacuation of casualties from the divisions, they are concentrated at the clearing stations, and removed therefrom by collecting companies belonging to a medical regiment of the corps or army, and carried back to one of the following:

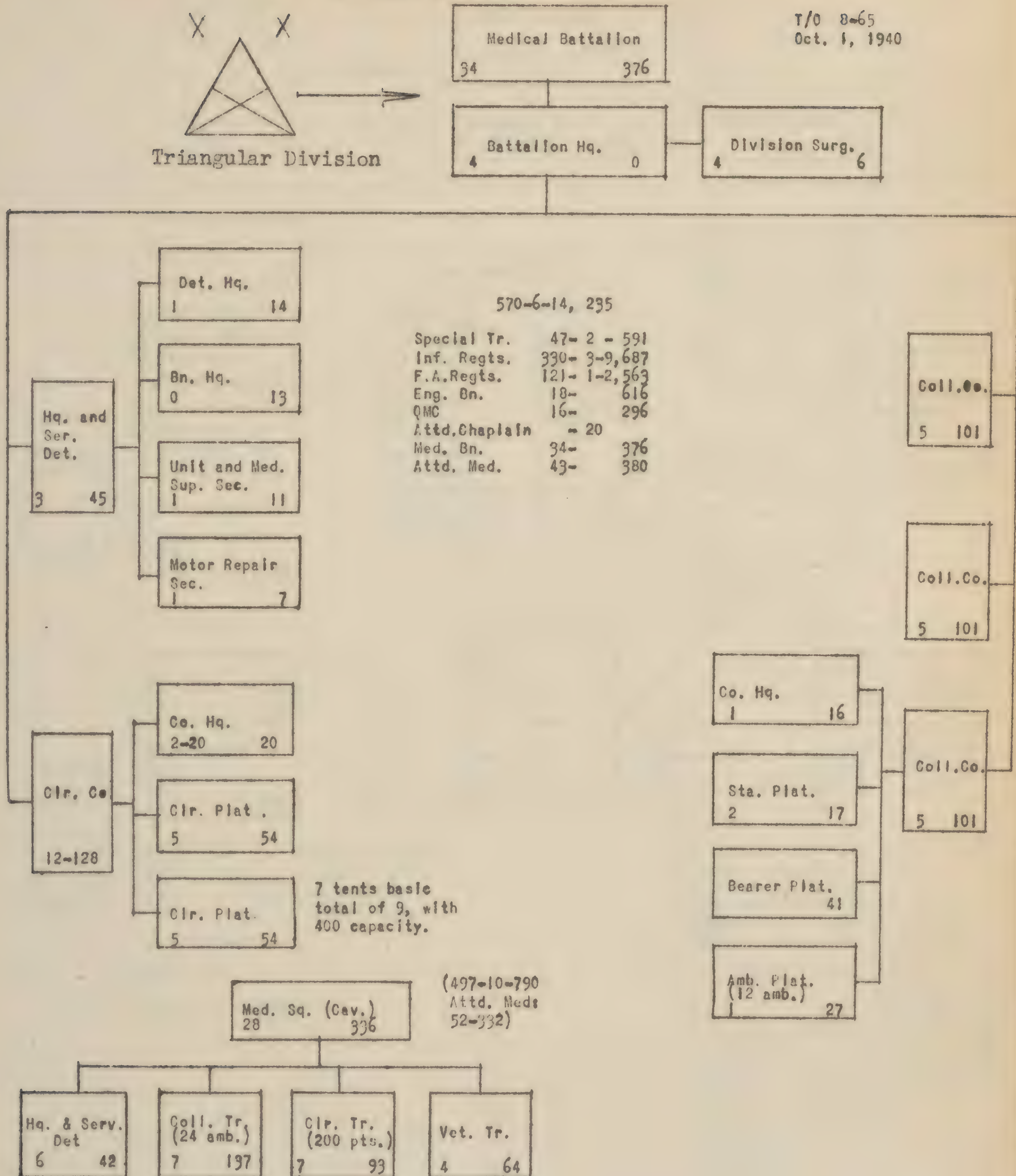
Surgical hospital
Evacuation hospital
Convalescent hospital

The Surgical Hospitals furnish special facilities for immediate surgical care of serious types of casualties. They are movable by train or truck, and generally intended to move forward to the various division clearing stations already filled with casualties, and there to take over these patients, operate upon them and pass them on to an evacuation hospital, thereby permitting the surgical hospital to move on to another clearing station. The surgical hospital consists of personnel, 4 operating rooms, sterilizers, surgical equipment, temporary tentage, etc. The capacity of each complete unit is 400 patients each.

The Evacuation Hospital is a more or less fixed medical organization, with a capacity of 750 patients. This installation is intended to relieve the surgical hospitals of their cases already operated upon, or in times of emergency to take over the casualties directly from the surgical hospitals and divisional clearing stations, and then operate upon such casualties in the evacuation hospital itself. This entire organization can be transported by train or truck, but is not intended to move as often as the surgical hospital.

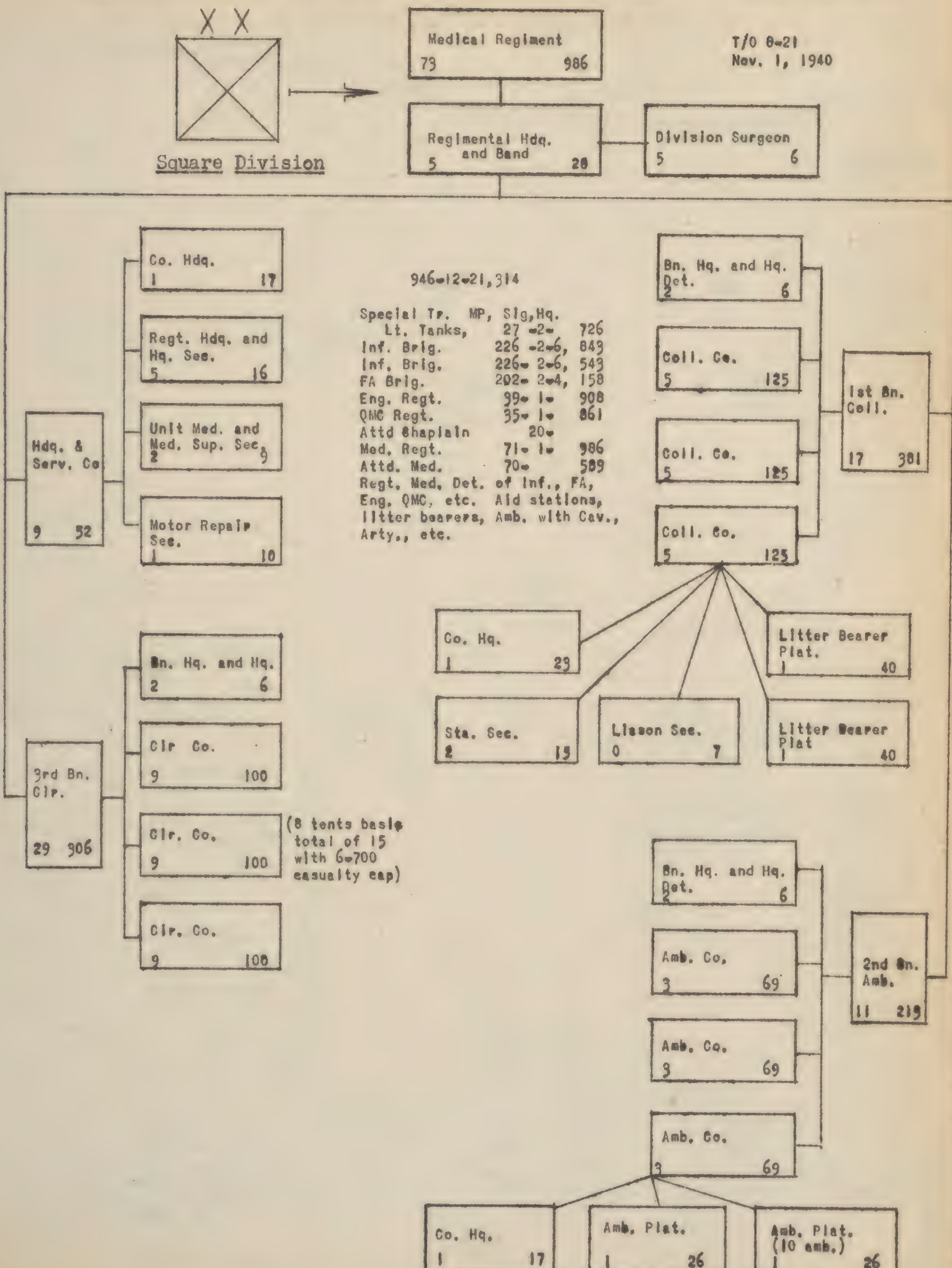
The Convalescent Hospital receives slight and convalescent cases from evacuation hospitals, and at times directly from the clearing station themselves. Its functions are to relieve evacuation and other hospitals of the care of slight cases and venereals, etc., in order to permit evacuation and other hospitals to maintain necessary mobility.

MEDICAL SERVICE IN THE FIELD



MEDICAL SERVICE IN THE FIELD — Medical Regiment — Square Division

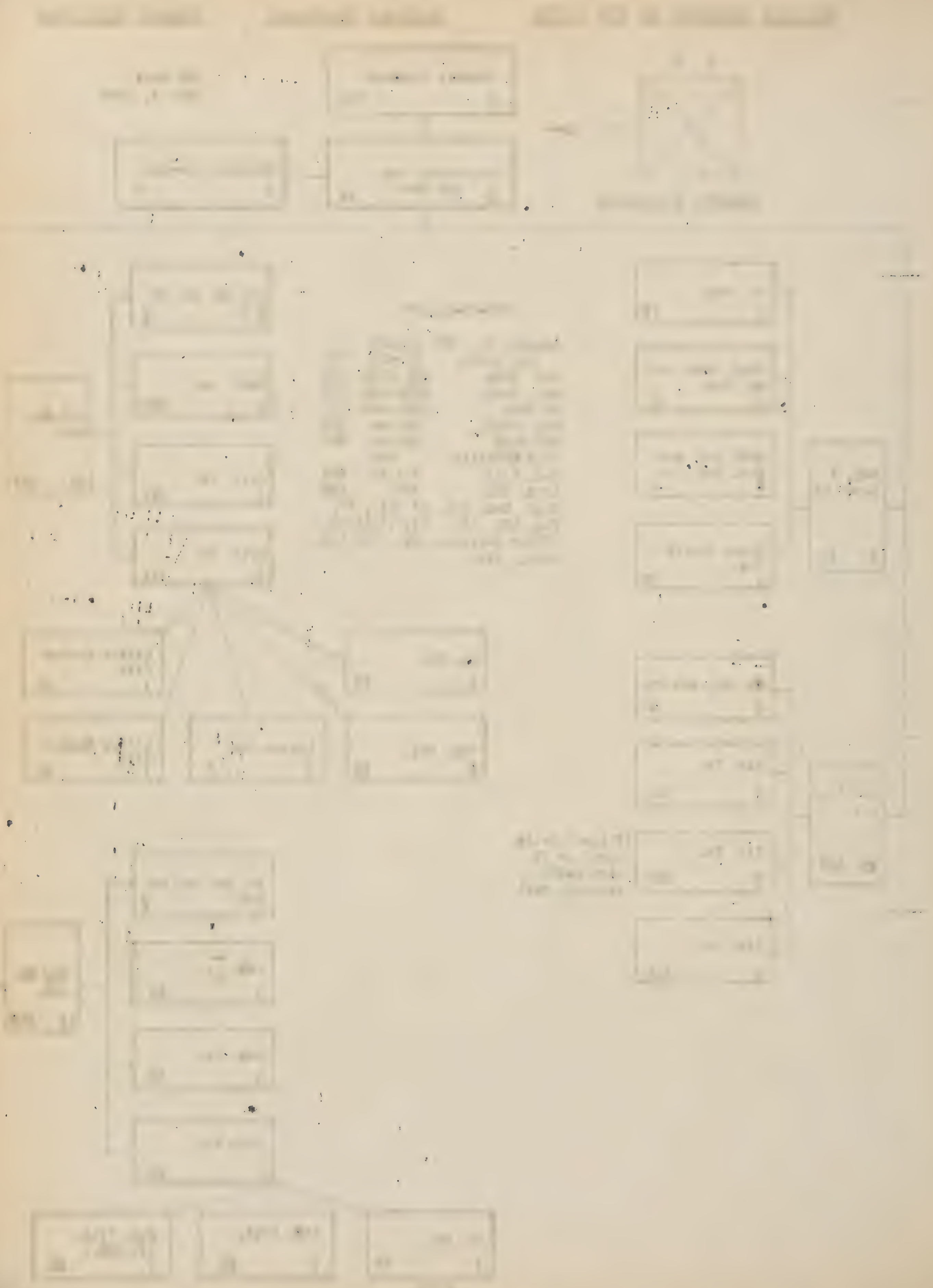
T/0 8-21
Nov. 1, 1940



946-12-21,314

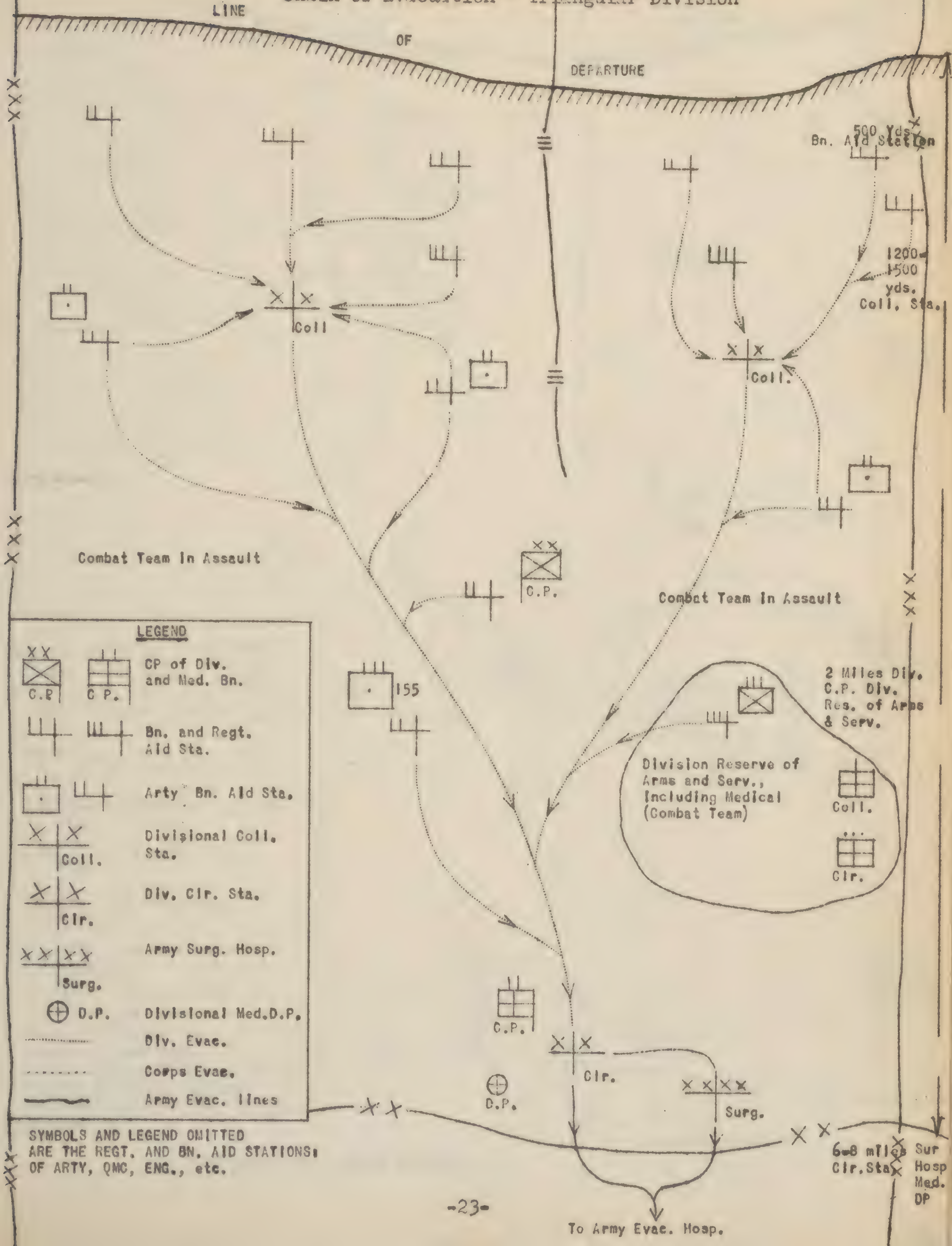
Special Tr. MP, Sig, Hq. Lt. Tanks,	27 -2-	726
Inf. Brig.	226 -2-6,	843
Inf. Brig.	226- 2-6,	543
FA Brig.	202- 2-4,	158
Eng. Regt.	39- 1-	908
QMC Regt.	35- 1-	861
Attd Chaplain	20-	
Med. Regt.	71- 1-	986
Attd. Med.	70-	589

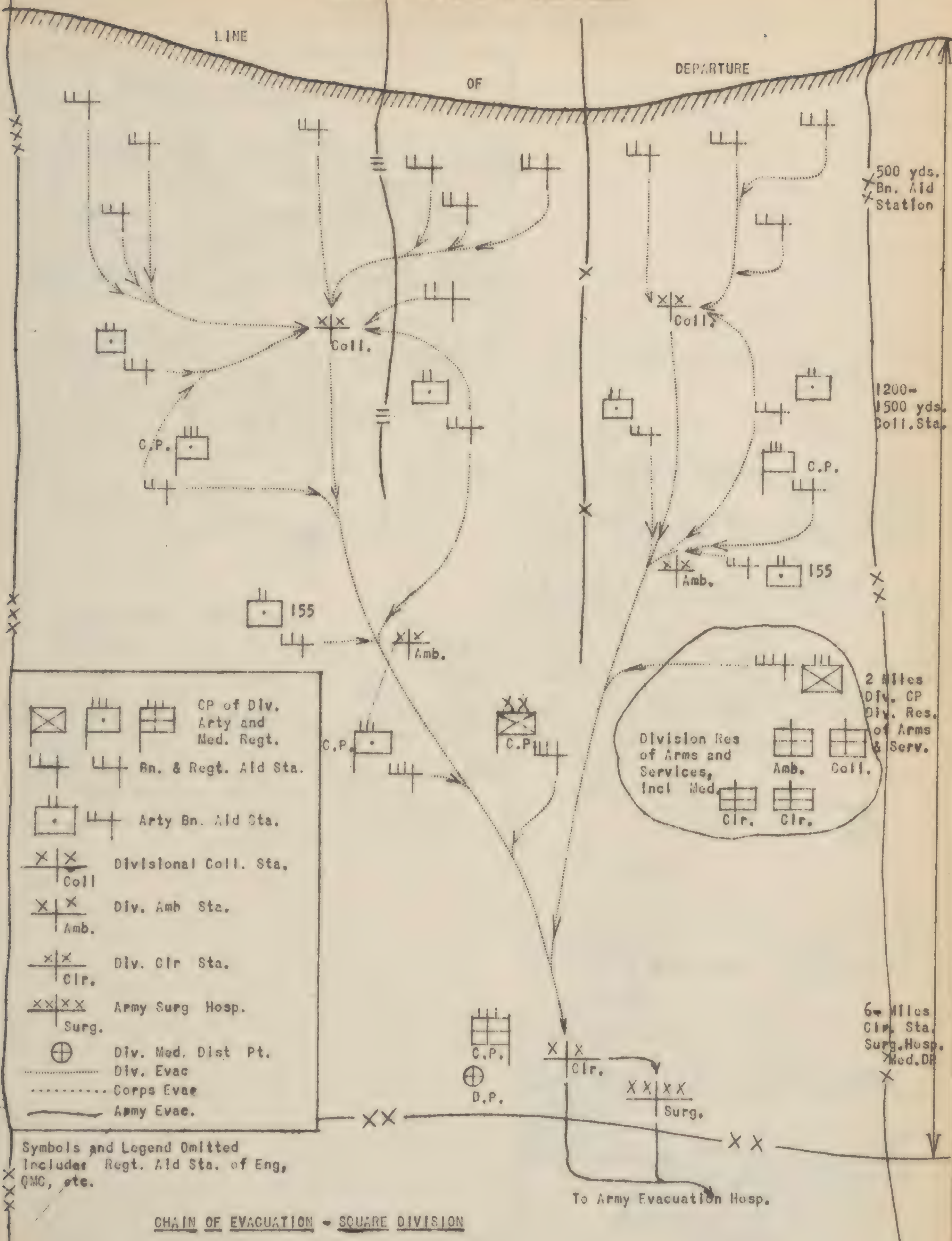
Regt. Med. Det. of Inf., FA, Eng. QMC, etc. Aid stations, litter bearers, Amb. with Cav., Arty., etc.



MEDICAL SERVICE IN THE FIELD

Chain of Evacuation - Triangular Division





CHAIN OF EVACUATION - SQUARE DIVISION

Name and Army Serial Number						
Tanner, James W. Jr. 6951044						
Grade: Corpl.	Company: "A"	Regiment & Arm or Service: 2nd Med. Bn.				
Div: 2nd	Corps: 8th	Army: 3rd	Age: 20	Race: W	Nativity: Tex.	Serv. Years: 2 1/2
Station when Tagged: Camp Bullis, Texas					Date: May 15/40	Hour: 1:15 A.M.
Diagnosis: If injury, state how, when where incurred. F. S. Rt. Femur upper 1/3 while unloading truck, sack of sugar fell on patient's leg Co. "A" 9th Inf.						
Line of Duty: yes						
Treatment: Splint applied						
Antitetanic Serum: Dose Time						
Morphine: Dose 1/4 gr. Time 1:15 A.M.						
Disposition: Coll. Sta. Co. "A" 2nd Med. Bn.					Date: May 15/40	Hour: 1:15 P.M.
Signature, with Rank and Organization: Thomas Paul D., Pvt. Co. "A", 2nd Med. Bn.						
Form 52b-Medical Department, U.S.A. (Revised October 15, 1940)						

16-15434

A.S. No. 6951044			
Surname: Tanner	Christian Name: James W. Jr.		
Rank: Corpl.	Company: "A"	Regiment or Staff Corps: 2nd Med. Bn.	
Age (yrs): 20	Race: W	Nativity: Texas	Serv. (Yrs): 2 1/2
Date, hour, and station where tagged: 2 - May - 41 - 3:30 P.M. Near Camp Bullis, Texas, 2nd Bn Aid Sta. 9th Inf.			
Diagnosis: F. C. C. upper 3rd, rt. Femur			
Treatment: Wound Dressed, Splint Applied			
Disposition: Coll. Sta. Co. "A" 2nd Med. Bn.			
Signature: Curtis P. Taylor, Pvt. Co. "A" 2nd Med. Bn.			
Form 52b Medical Department, U.S.A. (Authorized June 22, 1940)			

3-7906

<table>
<tr><td colspan="7">Name and Army Serial Number</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="2">Grade</td><td colspan="2">Company</td><td colspan="3">Regiment & Arm or Service</td></tr>
<tr><td>Div</td><td>Corps</td><td>Army</td><td>Age</td><td>Race</td><td>Nativ-ity</td><td>Serv. Years</td></tr>
<tr><td colspan="5">Station when Tagged:</td><td>Date</td><td>Hour</td></tr>
<tr><td colspan="7">Diagnosis: If injury, state how, when, where incurred

Line of Duty</td></tr>
<tr><td colspan="7">Treatment

Antitetanic Serum: Dose Time
Morphine: Dose Time</td></tr>
<tr><td colspan="5">Disposition:</td><td>Date</td><td>Hour</td></tr>
<tr><td colspan="7">Signature, with Rank and Organization:</td></tr>
<tr><td colspan="7">Form 52b-Medical Department, U.S.A.
(Revised October 25, 1940)</td></tr>
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16-15434

<table>
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<tr><td colspan="4">A.S. No.</td></tr>
<tr><td colspan="2">Surname</td><td colspan="2">Christian Name</td></tr>
<tr><td>Rank</td><td>Company</td><td colspan="2">Regiment or Staff Corps</td></tr>
<tr><td>Age (yrs)</td><td>Race</td><td>Nativity</td><td>Serv. (Yrs)</td></tr>
<tr><td colspan="4">Date, hour, and station where tagged:</td></tr>
<tr><td colspan="4">Diagnosis:</td></tr>
<tr><td colspan="4">Treatment</td></tr>
<tr><td colspan="4">Disposition</td></tr>
<tr><td colspan="4">Signature:</td></tr>
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Medical Department, U.S.A.
(Authorized June 22, 1920)</td></tr>
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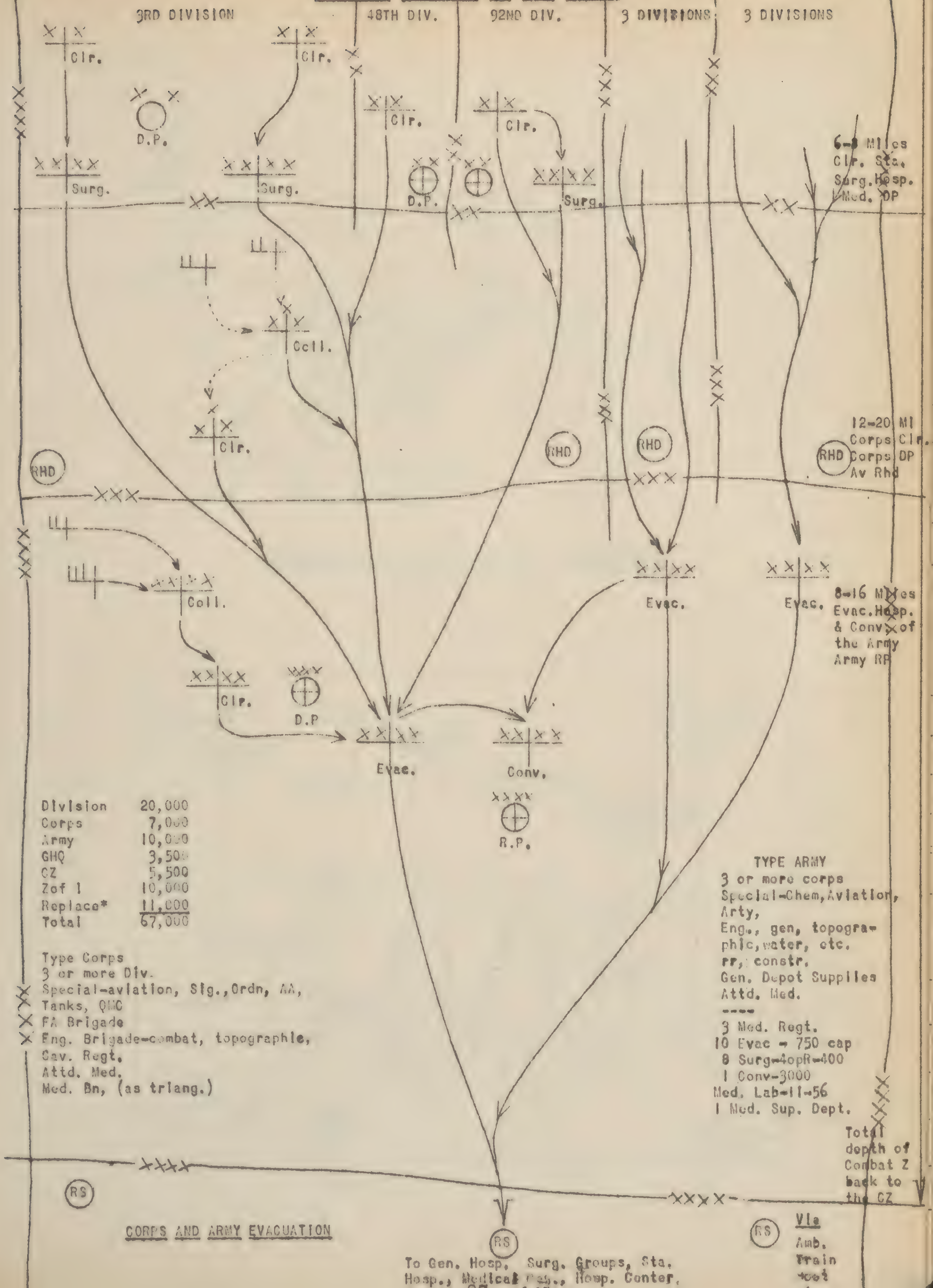
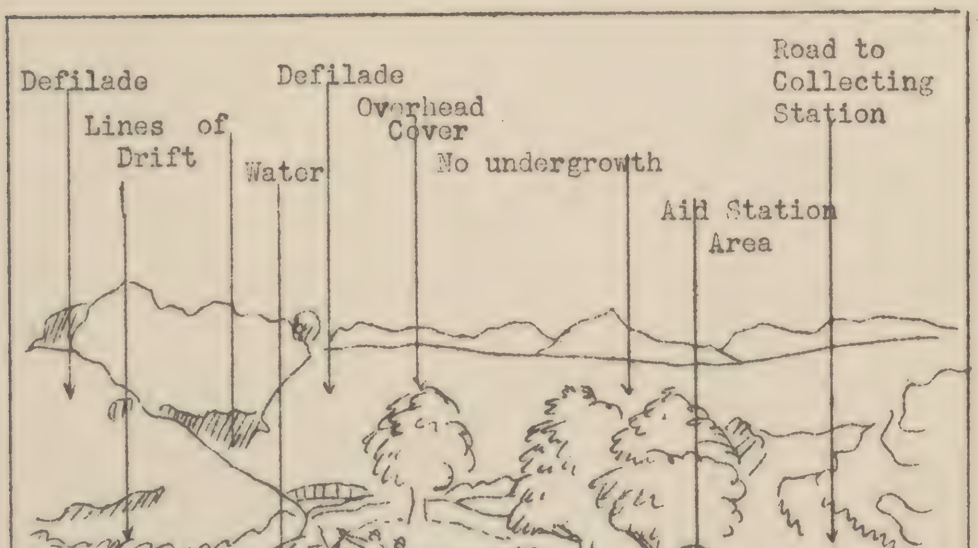
MEDICAL SERVICE IN THE FIELD



Reporting Location of Bn. Aid Station



ADMINISTRATION OF MILITARY HOSPITALS

ADMINISTRATION OF MILITARY HOSPITALS

FUNCTION

The ultimate aim in the management of a hospital is to provide the best professional care of the sick and injured.

TYPES OF MILITARY HOSPITALS

A. In War.
   1. Mobile Hospitals - they form a constituent part of the mobile forces. They are established in the combat zone and comprise:
      a. Evacuation hospitals.
      b. Surgical hospitals.
      c. Convalescent hospitals.
      d. Clearing stations - operated by clearing companies of medical regiments, medical battalions or medical squadrons.
   2. Fixed or Non-Mobile Hospitals - they serve the same purpose in war or in peace. They are established in the zone of the interior and the communications zone. Three or more general hospitals may be grouped at one place into an Administrative and Clinical organization known as "Hospital Center". A part of the Hospital Center may form a "convalescence Camp". In the Fixed or Non-Mobile Hospitals are classed:
      a. Station hospitals.
      b. General hospitals.

B. In Peace - Military hospitals in time of peace are of two general types:
   1. Station Hospitals - they function under local commanders.
   2. General Hospitals - they function, in peace time, under the immediate direction of the Surgeon General.

ADMINISTRATION OF FIXED HOSPITALS

For convenience of administration and in the interest of professional efficiency, the Commanding Officer (Surgeon) of each Army Hospital, organizes the professional and other activities of his hospital into services and prescribes the number and the line of control over them and their relationship to each other. In the absence of the Commanding Officer, the Registrar, or some Medical Officer designated by the Commanding Officer, may command the detachment of patients.

THE ADMINISTRATIVE SERVICE

The Administrative Service of a fixed hospital includes such personnel and activities as the Commanding Officer of the hospital may prescribe.

A. Personnel:
1. Commanding Officer.
2. Executive Officer.
3. Adjutant.
4. Personnel Officer.
5. Registrar.
6. Officer of the Day.
7. Chaplain.
8. Chief Nurse.
9. Mess Officer.

B. Activities.
1. Admission and discharge of patients.
2. Hospital inspection.
3. Detachment, Medical Department.
4. Hospital Mess.
5. Fire control.
6. Summary court.
7. Recruiting.
8. Post Exchange.
9. Training of detachment.

TITLES OF DUTY PERSONNEL

DUTY	TITLE
Commanding Hospital (Surgeon)	Commanding Officer
In charge of a service	Chief of _____Service
Commissioned assistant on a service	Asst.Chief_____Service
Officer in charge of records of sick and wounded	Registrar
Officer in charge of a ward	Ward Officer
Commissioned assistant in a ward	Assistant Ward Officer
Nurse in charge of nurse staff	Chief Nurse
Nurse in charge of a ward	Head Nurse
Principal enlisted assistant in a ward	Wardmaster
Other enlisted assistant in a ward	Ward Attendant

DUTIES OF THE COMMANDING OFFICER OF A HOSPITAL

A. General.
1. He is responsible for the administration, delegation of duties, discipline and efficient operation of the hospital.
2. He is responsible for the proper preparation of all records, reports and registers.
3. He is responsible for the care and safekeeping of all public property which may come under his command.
4. He is responsible for the proper expenditure of funds and supplies.
5. He is responsible for the preparation of requisitions, returns and pay rolls of the hospital.
6. He is responsible for the fire control of the hospital buildings.

B. Patients.
1. He determines what patients are admitted and discharged from the hospital.
2. He or a commissioned assistant, commands the detachment of patients.
3. He is responsible for supervising the care and treatment of all patients.
4. When a patient is seriously ill, the commanding officer communicates the fact to the person designated by the patient, as well as to inform the chaplain on duty.
5. He provides for ward assignment according to the patient's complaint.
6. In case of death, the required report is made by the commanding officer.

C. Personnel.
1. The Commanding Officer commands them as a detachment.
2. He assigns them to appropriate duty.
3. He reports their proper returns in the capacity they serve.
4. He requires proper performance of duty by the entire hospital personnel.
5. He requires and enforces proper regulations as to sanitary, disciplinary and other requirements of the hospital.

D. Inspections.
1. The Commanding Officer inspects or directs inspection of the hospitals daily and of the Detachment, Medical Department, each Saturday.

<u>PERSONS WHO MAY BE ADMITTED TO ARMY HOSPITALS</u>

1. All persons in active military duty.
2. Persons belonging to the Navy and Air Force.
3. Persons belonging to governmental departments, such as, Civil Service, beneficiaries of U. S. Veterans' Administration Bureau, and certain civilians employed in government service.

<u>HOSPITAL ORGANIZATION</u>

The general organization conforms to Army Regulations 40-590 and consists of two major divisions:

A. Administrative.
1. The administrative division consists of personnel and activities as follows:
   a. Commanding Officer.
   b. Executive Officer.
   c. Adjutant.
   d. Personnel Officer.
   e. Registrar.

f. Officer of the Day.
g. Chaplain.
h. Chief Nurse.
i. Mess Officer.

B. Professional.
1. The professional division consists of services subdivided into sections and clinics as follows:
   a. Surgical Service.
      (1) Anesthesia.
      (2) General Surgery.
      (3) Septic Surgery.
      (4) Obstetrics and Gynecology.
      (5) Urology and Venereal Diseases.
      (6) Eye, ear, nose and throat.
      (7) Roentgenology.
      (8) Physiotherapy.
   b. Medical Service.
      (1) General Medicine.
         (a) Cardiovascular.
         (b) Gastro-intestinal.
      (2) Contagious Diseases.
      (3) Neuropsychiatry.
      (4) Dermatology.
      (5) Detention.
   c. Laboratory Service.
   d. Dental Service.
   e. Out-Patient Service.
      (1) Pre-natal Clinic.
      (2) Pediatric Clinic.
      (3) General Examinations and Treatments.
      (4) Prophylaxis.
      (5) Pharmacy.

HOSPITAL BUILDINGS

The Commanding Officer is responsible for hospital buildings and must not permit them to be used for other purposes such as quarters, mess, etc., except for patients, personnel and civilians on duty. If deemed absolutely necessary, mess and quarters for officers on duty may be permitted.

FIRE CONTROL

The Commanding Officer is responsible for instituting proper measures for prevention of fires. He may include measures prescribed by higher authorities such as appointment of competent fire marshal, formulation of adequate regulations for prevention of fire and periodic fire drills, etc.

REPORTS, RECORDS AND RETURNS

The Commanding Officer is responsible for proper and timely rendition of all reports and returns pertaining to the hospital as well as official records thereof.

SURGICAL SERVICE

The Chief of the Surgical Service will be responsible for the care of all patients in the Surgical Department of the hospital. He will ordinarily serve as operating surgeon and will be directly in charge of the patients in the officers' and women's wards. He will be responsible for the presence at all times, in all sections of his department, of sterile equipment, appropriate apparatus and sterile solutions, etc.

MEDICAL SERVICE

The Senior Medical Officer assigned to the medical service will be known as the Chief of the Medical Service.

He is responsible for the proper conduct of all sections and wards included in his service and will make such inspections and require such reports as may be necessary.

LABORATORY SERVICE

The Senior Medical Officer assigned to the laboratory is known as the Chief of the Laboratory Service. He is responsible for proper maintenance of the service, including the character and accuracy of all work done in his service.

The laboratory will furnish the following services for the hospital:

1. Routine examinations of urine, feces and sputum.
2. Darkfield examinations.
3. Blood counts, blood chemistry determinations.
4. Collection and shipment of blood for Wassermann test, cerebrospinal fluid for examinations and specimens of tissue for histo-pathological examination.
5. Examination of water.
6. Selection of blood donors.
7. Preparation of Dakin's Solution.
8. Maintain the supply of biologicals and insulin.
9. Perform autopsies.

WARD OFFICER

The Ward Officer has charge of the ward to which he is assigned. He is responsible to the Chief of Service for:

1. The care, comfort, diets and treatments of all the patients therein.
2. For the proper performance of duties of nurses, enlisted men and other attendants in compliance with hospital regulations.
3. For the economy of all government supplies and materiel.
4. For the cleanliness and sanitation of the ward and surrounding grounds.

5. For the discipline and general conduct of the ward.
6. He makes a complete inspection of his ward and grounds each morning.

THE REGISTRAR

1. The registrar has charge of all medical and surgical records and sees that careful and accurate clinical histories, statistical tables, etc., are kept.
2. He prepares all reports and returns pertaining to the sick and wounded.
3. If the commanding officer does not assume direct command of the detachment of patients, the registrar may have that function, if designated by the Commanding Officer.
4. In this capacity he has charge of the service records, accounts, and returns of patients.
5. The registrar has a responsibility in connection with patients' money and valuables, namely:
   a. Upon admission of patient to the hospital, patient is informed the hospital will receive for safekeeping money, valuables, jewelry, keepsakes, etc., for which a receipt is issued by a commissioned officer.
   b. In case patient is unconscious, a witness must be present when money and valuables are removed for safekeeping.
   c. Money, valuables, etc., are receipted for and received by the registrar.
   d. Articles of considerable value are deposited in a bank or locked in hospital safe.
   e. Articles of lesser value may be stored in locked compartments in a well safeguarded room.
   f. Enlisted men are not permitted to receive money or valuables from patients for safeguarding.
   g. When a patient is discharged, transferred or dies, his money and valuables are disposed of in accordance with regulations for disposal of effects and public property.
6. Method of Accounting for Money and Valuables:
   a. Custodian or registrar keeps a book of receipt blanks and stubs (numbered serially).
   b. Registrar gives patient receipt listing money and valuables given him for safekeeping and patient signs duplicate stub.
   c. Money is deposited in bank or safe credited to "patient's fund".
   d. Custodian keeps patient's cash account which is balanced each month or when audited.
   e. Custodian keeps account of patient's money and valuables in a ledger.
   f. Patients withdrawing money or valuables must present receipt. Custodian notes on back of receipt and stub, date and amount of money withdrawn.

g. When money or valuables are withdrawn, patient is required to initial entries on his individual account in the ledger.
h. The Commanding Officer designates an officer other than the registrar to audit patient's funds at the end of each month.

PUBLIC PROPERTY

1. When practical patients on being sent to the hospital leave arms and accoutrements with their organization.
2. When brought to hospital, property is safeguarded as prescribed by regulations.
3. If patient's disability is slight, requiring but a few days, the property is kept intact, tagged and stored, and returned to him on return to duty; otherwise, if practical, it is turned over to his Company Officer whose receipt is required.
4. If not practical to turn property over to his Company Officer, the office at the hospital takes up Medical Department property in soldiers' possession and forwards receipt thereof to the accountable officer.
5. If hospital property officer is accountable for quartermaster or ordnance property, he takes up on quartermaster or ordnance papers all property belonging to those departments brought in by the patient; otherwise, he transfers such property to nearest representatives of said departments whose receipts are required.
6. Patient's Commanding Officer is immediately notified of all of above action.

PERSONAL EFFECTS OTHER THAN MONEY AND VALUABLES

1. Upon admission to the hospital these are checked and listed on patient's property card in his presence, and bundled and tagged for identification. If conscious, the patient signs the property card.
2. Soiled clothing is washed as part of hospital laundry and disinfected, if necessary, before stored.
3. Original property card is filed with hospital records and duplicate held by patient or kept at his bedside.
4. When patient returns to duty or is furloughed or discharged, and leaves hospital, the Property Officer restores effects and takes receipt therefor.
5. When patient dies or deserts, effects are disposed of as indicated in AR 615-300.
6. In case of transfer to another hospital, his effects are restored and receipted for by the patient.
7. If unable to take care of them, the effects are entrusted to the senior officer or enlisted man accompanying him.

FILES

The attendant in charge of the patients' clothing and baggage room, under the direction of the commanding officer, detachment of patients, will be responsible for the proper keeping of all records, and the safekeeping and care of all property in the storeroom. Records kept in the patients' clothing and baggage room will include.

LIVE FILE

A file of cards for the effects of patients in hospital, to be known as the Live File.

DEAD FILE

A file of cards for patients who have left the hospital and have taken their effects with them, to be known as the Dead File.

SUSPENDED FILE

A file of cards for patients who have left the hospital and have not taken their effects with them, to be known as the Suspended File.

INDEX LOCATION BOX

A suitable location index is maintained by the registrar of each hospital showing the name of each patient, the date of his admission, and the ward where he is being treated.

MEDICAL OFFICER OF THE DAY

The Medical Officer who is to serve as Officer of the Day is notified by a written order the day before. His tour of duty is 24 hours, commencing at 8:30 A.M. While so detailed, he acts in an administrative capacity for or in the absence of the Surgeon, to safeguard patients, government property, and perform the necessary professional duties for and in the absence of officers of the professional services.

A. Duties of the Medical Officer of the Day – they are of wide range and most important in character. It is his duty to give such orders and make such recommendations as may be to the best interest of the institution and for the time being to see that no patient is neglected or that any irregularities occur which might bring discredit upon the institution or upon the Medical Department as a whole. In general his duties are as follows:
   1. He will take the necessary steps to insure the proper conduct of all persons on duty.
   2. During his tour of duty he will remain on the reservation at all times and whenever he leaves the hospital for any purpose, will notify the noncommissioned officer in charge of quarters where he may be located during such absence.

3. He will make inquiry at the registrar's office regarding the total number of patients in the hospital, the number in each contagious, genito-urinary and detention ward.
4. He will obtain from the chiefs of service the names and locations of seriously ill patients and any pertinent instructions regarding them.
5. He will determine at once, after going on duty, the name of the noncommissioned officer in charge of quarters and will give the noncommissioned officer such instructions concerning his duties as may be necessary.

B. Inspections.

1. Hospital.
   a. The Officer of the Day accompanied by the noncommissioned officer in charge of quarters will make at least two (2) inspections of the hospital during the tour of duty, one being between 6:00 P.M. and 12:00 midnight, and one between midnight and 6:00 A.M.
2. Patients.
   a. He makes inspection during the night of all the patients in each ward, and gives such emergency treatment as may be required.
3. Mess.
   a. The Medical Officer of the Day will inspect at least one meal daily served to patients in the mess hall and in the wards. He will report upon the character of the food served, if unsatisfactory.
4. Fire Control.
   a. In the event of an outbreak of fire, the Medical Officer of the Day will immediately assume charge until the fire marshal or the chief of the fire department arrives, taking steps in the meantime to sound the alarm, put out the fire, and remove patients, if indicated.
5. Deaths.
   a. In case of death, in the absence of the Ward Officer, the Medical Officer of the Day will examine the body personally and superintend its removal to the morgue. He will make a record of the deceased's name, rank, organization and address of the nearest relative, and properly tag the body for identification. He will take precaution to insure safekeeping of the body. He will collect all money and valuables and other effects of the deceased, list them in duplicate, and deliver them to the registrar, taking the registrar's receipt on the duplicate copy of the list. He will see that the nearest relative and proper authorities are notified, exercising caution so there will not be a duplication of notification.

THE HOSPITAL MESS

A. Mess Management.

1. At large hospitals, Commanding Officer may put mess under supervision of a junior officer.
2. Food supplies and rations are issued by Quartermaster Corps or come from hospital gardens and articles purchased from the hospital fund.
3. If rations are not sufficient for hospital needs, Commanding Officer makes application for additional rations through the Adjutant General.
4. Hospital mess constantly supervised by the Commanding or Mess Officer. He requires all bills to be paid at the end of each month.
5. Bills of fare and prescribed diets made out under supervision of the Commanding Officer or Mess Officer, and posted in wards and kitchens.
6. Ward Officer after rounds fills out diet card from 73 M.D., covering diet requirement for 24 hours.
7. Hospital mess placed under immediate charge of competent non-commissioned officer, the mess sergeant.

B. Mess Sergeant.

1. The mess sergeant supervises the mess, cooking and serving of food.
2. He is responsible for the cleanliness of the kitchen, mess halls, and storerooms and for the orderliness and cleanliness of cooking utensils.
3. He prepares a daily list of articles needed for the mess and submits it to the mess officer.
4. He is in charge of cooks and K.P.'s and is responsible for their conduct, work and cleanliness.

C. Mess Officer.

1. Has charge of and is responsible for the general administration of all messes that pertain to the hospital.
2. He is charged with the responsibility of selecting, purchasing, care, issue, preparation and serving of all food supplies, except for the nurses' mess, which functions under the immediate supervision of the chief nurse.
3. He will see that the equipment for handling, preparing and serving food is adequate, clean and properly cared for.
4. He is custodian of the hospital fund and as such will keep account for and disburse the fund in accordance with existing regulations.
5. He keeps concise and complete records of all transactions, inventories, and cash disbursements, of the mess.

COMMUTATION OF RATIONS

A. Classes.

1. The ration of any of the following classes, while a patient in a hospital, dispensary, hospital station, hospital ship, army transport, hospital train, or convalescent camp, pertaining to the army, is commuted at the rate indicated in B.
    - a. Enlisted men in the active service of the United States (including enlisted men of the Philippine Scouts).
    - b. Enlisted men of the National Guard, National Guard Reserve, or Enlisted Reserve Corps admitted from training camps or service schools.
    - c. Discharged soldiers undergoing treatment.
    - d. Applicants for enlistment.
    - e. Civilian employees of the army who are entitled to subsistence at public expense.
    - f. Prisoners.
    - g. Destitute persons admitted to hospital.

B. Rates.

1. At tubercular establishments, actual cost, plus 90%; all others actual ration cost, plus 50%.
2. Reserve officers training corps while in hospital has same rate ration allowance as for trainees under instruction at such camp.
3. National Guard and National Guard Reserves (officers) entitled to ration at government expense while in hospital which is commuted at rate of ration charge for officers of Regular Army.

C. Vouchers Covering Commutation.

1. Vouchers covering the commutation referred to above are prepared by the custodian of the hospital fund of the Medical Department unit concerned.

SUBSISTENCE AND MEDICINE CHARGES

A. Subsistence Charges.

1. The following is the schedule of rates for subsistence charges for patients in Medical Department establishments (except the Army and Navy and Fitzsimons General Hospitals) who are not entitled to commutation of rations. Rates for patients in the Army and Navy and Fitzsimons General Hospital are found in AR 40-605 and 40-610.
    - a. For officers, warrant officer of the United States Navy and Marines and nurses, $1.00 a day, except in hospital stations where the rate is an amount equal to the commutation rate prescribed, plus 10 cents a day.

Also for civilians on the status of officers, $1.00 a day, except in hospital stations.

Also Red Cross workers, physiotherapy aides and dietitians' pay $1.00 per day in fixed hospitals.

b. For retired enlisted men of the Army, Navy and Marine Corps and for civilians on the status of enlisted men, an amount equal to the garrison ration plus 50%, plus 10 cents a day; plus 25 cents for enlisted status and 50 cents for officers' status per day for maid service. (Circular Letter No. 13, S.T.O., dated February 20, 1941).

B. Medicine Charges

1. Medicine (including dressings) charges are made for patients in Medical Department establishments who are not entitled to medical care and treatment at the expense of Army appropriations, including officers and enlisted men of the Navy and Marine Corps, civilian employees and civilians.
2. The rate of medicine (including dressings) charges for patients in Medical Department establishments is 50 cents per day, unless the actual cost of the medicine (including dressings) exceeds that amount, in which event the rate will be actual cost of the medicines (including dressings).

MEDICAL INSPECTOR

1. The Medical Inspector will make frequent inspections of all offices, departments, services and wards to determine whether or not the hospital and other regulations are being complied with.
2. He will observe and report upon such matters as may come to his attention with a view to the correction of irregularities, and will promote general efficiency.
3. He will scrutinize closely all matters affecting directly or indirectly the health of the command.
4. He will keep such records as will permit accurate and complete reports of sanitary conditions and actions taken or recommended.
5. His duties as Medical Inspector of the command are fully set forth in AR 40-270, "The Medical Inspector".

THE CHIEF NURSE

A. General.

1. The Chief Nurse is under the immediate jurisdiction of the Commanding Officer.
2. She will have general supervision of the nursing service in all wards and services in which members of the Army Nurse Corps are on duty.
3. She will be in charge of the nurses' quarters and the nurses' mess.
4. She will be responsible for the orderly condition of all departments in the nurses' quarters and for all property contained therein.

5. She will report promptly any repairs which may be required at the nurses' quarters.

B. Instruction.

1. She will familiarize herself with Army Regulations insofar as they relate to the Army Nurse Corps, and will instruct the nurses under her supervision in such regulations and in the duties peculiar to army work.
2. When required by the Commanding Officer, she will supervise the instruction in practical nursing of the Medical Department enlisted men on ward duty.

C. Supervision of Nurses.

1. She will exact the proper performance of duties, and is responsible for discipline among the nurses, both on and off duty.
2. She will report any neglect of duty, serious breach of discipline, misconduct to the Commanding Officer.
3. She is responsible for the comfort and well-being of the nurses under her charge, and will promptly report to the Commanding Officer any matters which unfavorably affect the same.
4. She will arrange the hours of duty and assignment of all nurses, subject to the approval of the Commanding Officer, and will be responsible for the execution of all orders relating thereto.
5. She will also bring to his attention, at once, any cases of illness among the nurses.

D. Records and Preparations of Reports, etc.

1. She will be responsible for the proper keeping of the required records of the members of the Army Nurse Corps and will prepare the pay vouchers, reports, returns, and official correspondence pertaining thereto.

<u>DUTIES OF THE HEAD NURSE</u>

1. The Chief Nurse will designate one nurse for each ward to act as its responsible nursing head.
2. Under the direction of the ward officer the head nurse will be in charge of the ward, patients, nurses, enlisted personnel and other persons assisting in nursing care of the patients, and will be respected and obeyed accordingly.
3. She will advise the Chief Nurse concerning the efficiency of nurses under her, and will report upon efficiency of the enlisted personnel in the ward to the ward officer.
4. Her hours of duty will be same as other nurses.
5. She will be responsible for:
   a. The receiving and recording of all orders relating to the care and treatment of patients in her ward.
   b. The proper administration of all medicines and treatment.

c. The proper serving of all foods in the ward.
d. The careful, accurate, and legible preparation of all ward records and routine reports required. In this connection particular care will be taken in maintaining the ward narcotic register.
e. The procurement of such medicines from the pharmacy daily as are required by the ward officer. The Head Nurse will keep opiates, narcotics, alcohol and alcoholic liquors under lock and key at all times, retaining the key in her personal possession. She will keep an account of all receipts and expenditure of such drugs in a book provided for this purpose. The account will be balanced monthly showing all receipts and expenditures and the balance on hand.
f. The checking and care of ward property and preparation of requisitions for needed supplies for the signature of the ward officer. Such articles as are needed for use in the ward will be drawn from the proper supply department at the prescribed time and receipt given for same. All property not in use in the ward will be kept in the storeroom. Surplus property will be turned in to the proper supply department.
g. The cleanliness, orderliness of the ward, other rooms and space connected with the ward activities. The linen storeroom will be kept in a neat and clean condition at all times. It will be kept locked. The head nurse will keep the key to the linen storeroom in her personal possession.
h. The proper observance of the hospital regulations and rules for patients.
i. The proper bathing of patients in the ward. All patients in hospital should receive baths twice a week and bed patients at least every second day unless contraindicated.
j. The recording of the exact hour and minute of admission on Form 55j in the case of each patient admitted to the hospital and the time the patient is first seen by a medical officer.

DUTIES OF NURSES

1. The duty of any army nurse shall be such as is usually performed by a trained nurse in civil hospital of like character as far as is practicable. Their tour of duty will not ordinarily exceed eight hours per day.
2. A nurse will not be required, except under stress of emergency, to serve more than one month in three on night duty.

3. Day nurses are at all times responsible to the head nurse for the nursing service in the wards to which assigned, under the direction of the ward officer.
4. Night nurses are responsible during the night to the supervising night nurse, if there is one; otherwise, they are directly responsible to the Chief Nurse for the nursing service in their respective wards. In either event, the night nurses, on being relieved by the day nurses, will make a written report of their work to the supervising night nurse or the Chief Nurse, as the case may be.

DUTIES OF WARDMASTER

This position is usually held by a noncommissioned officer. He is directly responsible to the head nurse, and in turn to the ward surgeon. His duties are usually directed by the head nurse, and he is in charge of the enlisted men of the ward. It shall be his duties to supervise and direct the proper policing of the ward, the proper conduct of the enlisted personnel and patients. He is in no manner responsible for administration of any type medications except enemas, and then only upon direction of the proper authority. Quite frequently he is in charge of linen exchange, the proper care of ward fixtures, furniture, floors, etc. He may also be detailed to see that the requisition for medicine and supplies are obtained at the proper time. He assists in the collection of patients' clothing upon admission, and their return from storage upon the patients' discharge. He may assist in undressing or dressing of patients, and also administering to their comforts in a general manner. He may direct the enlisted personnel to assist in any of the ward duties that he may feel that they are capable of performing.

DUTIES OF ENLISTED PERSONNEL

The enlisted personnel are usually chosen for ward work because of some past experience or particular adaptability. They ordinarily have no special duties, but assist in the general ward work, or they are directed by the ward master, head nurse, or ward surgeon.

ROUTINE ORDER OF PATIENTS ENTERING A MILITARY HOSPITAL

Patients entering hospital are either Ambulatory (walking) or Ambulance (carried cases). They enter the hospital through the Receiving Office of Outpatient Department or the First Aid Department.

In either case preliminary examination and first aid treatment may be given and necessary data for the admittance record slip (W.D., M.D. Form No. 55a) (Clinical Record Brief) is obtained. This data is obtained by the admitting officer, or in his absence, by the medical officer of the day. The personal affects slips (W.D., M.D. Form No. 54a) are made out in triplicate and signed by the patient. He retains one; one is kept on file and the other sent to the Registrar's Office. The money and valuables are deposited to the patient's credit and placed in the hospital safe.

In case the patient's condition warrants hospitalization, he is sent to the ward most suitable for his condition, accompanied by the admittance report slip, 55a M.D.

In case of serious illness the patient may go direct to the ward where admittance card is made out and emergency surgical cases may go direct to surgery, if condition indicates the necessity for immediate surgery.

At the ward the patient is given hospital linen. His linens are sent to the laundry and his clothing tagged and stored until needed. If necessary he is bathed, but as a rule, no treatment given until he is seen by the Ward Medical Officer, who makes a complete physical examination and orders necessary treatment and tests.

The clinical record blanks of the 55 series, necessary for each particular case, are filled in by the medical officer or nurse or attendant appointed by him.

Special forms as for Surgery or X-Ray are completed as indicated by patient's physical findings.

Necessary laboratory forms are usually made out by the head nurse.

Daily physical examination determines progress made by the patient. This information is recorded on the progress report 55.

If complications develop or surgical measures are necessary, the ward officer calls in the Chief of Service who makes recommendations. At that time the required slips are made out by the ward officer.

If the patient convalesces satisfactorily and can be discharged from the hospital, the Commanding Officer, or his representative, discharges him, either to duty; to quarters for further convalescence; to another ward, if necessary, for further observation and treatment; to another hospital in case of insanity (with the approval of the Surgeon General); or discharge from duty as in case of permanent disability - subject to the approval of the Surgeon General.

In the event of death of soldier, the attendant or nurse notifies the ward officer, or if he is not on duty, the officer of the day, who examines the body and determines whether or not the patient has died. If so, the Death Report is made out and sent to the Registrar. The body is sent to the morgue where it comes under the supervision of the Chief of Laboratory Service who directs its preparation for burial. The various aperatures are plugged with cotton to prevent escape of secretions or fluids. It is washed, shaved, dressed and properly tagged, (usually one on big toe and one on the thumb), unless autopsy is requested. In this case the autopsy is done by the Laboratory Section. This precedes the preparations for burial. The deceased's relatives are notified by the Commanding Officer who also notifies the chaplain and undertaker. All transportation in connection with burial is furnished by the quartermaster department.

LAUNDRY AND LINEN EXCHANGE

1. The Medical Supply Officer is in charge of laundering the hospital linen. He will maintain a sufficient supply of clean linen at the linen exchange to meet the regular requirements.
2. An enlisted man of the Detachment, Medical Department on duty in ward service or department, will attend to the exchange of soiled linen for clean linen and not delegate the duty to a patient.
3. The hospital laundry consists of:
   - a. Linen clothing and bedding of Medical Department.
   - b. Washable linens of patients being treated.
   - c. White coats and trousers of enlisted men.
   - d. Uniforms of army nurses.
   - e. Washable linens of employed civilians.

PHARMACY MANAGEMENT

The management and operation of the pharmacy at the hospital will be in conformity with paragraph 18, AR 40-590.

The Medical Officer in charge, or some medical officer appointed by the Commanding Officer, of the outpatient service, will, in addition to his other duties, be in charge of the pharmacy. He is responsible for its management and proper operation. He will cause the necessary records to be maintained in case of alcohol, alcoholic liquors and narcotics. He will be responsible for collection of medicine charges prescribed by AR 40-590 for civilians not entitled to medicine at public expense. These drugs must be kept under lock and key at all times. There will be also a "Poison" locker kept in the pharmacy with sufficient space for emergency amounts of alcohol, alcoholic liquors and narcotics for the use of the medical officer of the day.

Keys to the alcohol and narcotic vault will be held in the personal possession of the medical supply officer. None are kept on the keyboard. Keys to the pharmacy poison locker will be issued to the pharmacy officer. Duplicate keys will be kept in the hospital safe and not on keyboard.

THE MORGUE

The chief of the laboratory service is in charge of the morgue. He is responsible for all bodies from the time they are received from the wards until they are delivered to the undertaker.

He inspects all bodies before turning them over to the undertaker and again at the undertaker's establishment after preparations are completed for shipment or burial.

A certificate of inspection will be submitted by the laboratory officer, stating whether or not remains are prepared and properly dressed for burial.

HOSPITAL FUND

The hospital fund is maintained in every hospital for the purpose of providing mess for the hospital personnel and patients, and authorized and legitimate recreation and entertainment.

The sources from which the hospital fund are derived are: Ration allowances of patients and enlisted men on duty; dividends from the post exchange; sales from the garden; money received for the subsistence of officers and civilians treated in hospital; the sale of property purchased with the hospital fund or products pertaining to the hospital fund; nurses subsisted in a mess conducted by the commanding officer.

The hospital fund is kept by the commanding officer or by the mess officer, or by an officer detailed by the commanding officer for this duty, who is held responsible for the loss of any portion of the fund not deposited in a bank or the hospital safe. Expenditures therefrom are limited to the purchase of food or other articles for the benefit of patients and enlisted men on duty in the hospital. Savings on food supplies (rations) may be spent only for the purchase of food for the messes.

A statement of the hospital fund is prepared monthly and audited by the hospital council, the proceedings of which are recorded on the retained statement of the hospital fund. Articles such as musical instruments and athletic appliances, purchased with the hospital fund, are known as "durable property" and remain the property of the hospital fund, being accounted for on the return. All hospital fund statements are finally approved and filed in the Surgeon General's Office.

PATIENT'S FUND

The custodian will deposit all money in the hospital safe or a local bank to the credit of "Patient's Fund". Money deposited in a bank will draw no interest unless the patients to whom it belongs signify in writing their consent to the transfer of any accrued interest to the hospital fund. The custodian will keep a patient's fund cash account wherein will be debited all money received from, and credited all money returned to patients. This cash account will be balanced at least once a month and then audited.

Any patient desiring to withdraw money or valuables will be required to present his receipt. The custodian will note on the back of the receipt and on the stub the date and amount of the withdrawal, and will require the patient to initial or sign both. In case of withdrawal of all the patient's deposits, the custodian will take up the receipt and attach it to the proper stub. Likewise, a patient on withdrawing money or valuables will be required to initial the entries thereof on his individual account in the ledger. In no case will money or valuables belonging to a patient be turned over to an enlisted man for transmission to the patient.

The commanding officer of the hospital will designate an officer other than the custodian to audit the patient's funds at the end of each month.

HOSPITAL RULES

A. The Commanding Officer of hospital is responsible for formulation and enforcement of the rules.

B. General Rules.

1. Officers in charge of public property must keep accurate account of it and its distribution.
2. Each person in charge of a hospital department is responsible for property of that department.
3. Property in possession of men must be left in good order; damaged articles must be accounted for.
4. A person assigned to hospital must familiarize himself with rules governing it.
5. All non-coms and privates of detachment must be present at all formations, unless excused.
6. All men for duty in kitchen and mess room will be on duty at least an hour before reveille.
7. Immediately after reveille each man must arrange bed and personal belongings in orderly manner (clothes cleaned, shoes brushed, etc.).
8. Beds overhauled and cleaned each week and mattresses aired, covers changed after monthly inspection.
9. Card with name of soldier attached to foot of bed.
10. Squad room always kept in orderly manner.
11. Men to pay attention to personal cleanliness - bathe at least once a week.
12. Members of detachment wear prescribed uniforms when on duty at station, when in wards have ward clothing, and when on fatigue duty, wear fatigue clothing.
13. No member of detachment can leave hospital except by permission of proper authority, or in case of emergency.
14. Immediately after breakfast, hospital is policed and cleaned, ready for inspection by the Commanding Officer.
15. No member of hospital personnel permitted to borrow from or have financial dealings with patients.
16. A non-commissioned officer in charge of quarters is detailed daily by roster from non-commissioned officers on duty.
17. Non-commissioned officer in charge of quarters makes inspection of all wards and quarters at such time as the Commanding Officer of hospital directs and reports:
    - a. All unauthorized absentees and non-commissioned officers in charge of detachment.
    - b. Sees no unauthorized lights are burning.
    - c. Gives alarm in case of fire and proceeds as ordered in fire regulations.
    - d. Is responsible for efficient duty of the general guard on hospital grounds at least once every hour.

RULES FOR PATIENTS

A. Patients are under the command of the surgeon of the hospital; they are under the direct command of the ward officer, and in the absence of the latter, the head nurse. In wards where there are no nurses on duty, they are under the jurisdiction of the ward master or non-commissioned officer in charge.

B. Rules for patients will be posted in each ward and should be read by all patients, who will be held accountable for their observance.

C. Patient's Effects: money and valuables will be kept with the Registrar or an officer designated by the surgeon who will give a receipt for money or valuables left in his trust. The hospital is not responsible for losses unless turned over to the proper authority. Patients receiving money or other valuables while in the hospital must deposit these likewise with the proper authority.

D. Hospital clothing and toilet articles for patients - clothing is provided for patients while in the hospital. All clothing brought to the hospital must be turned in to the clothing and baggage room. Patients coming to the hospital must bring with them their toilet articles, consisting of razor, shaving soap, tooth brush, tooth powder, comb and hair brush. No other articles will be brought. Towels and toilet soap will be furnished by the hospital.

E. Patients are forbidden to have any financial dealings with hospital enlisted personnel.

F. Conduct of Patients - loud noises, boisterous or improper action, the use of profane language, and gambling are forbidden; and no food, intoxicants, narcotic drugs, or other articles of drink, except as prescribed or authorized, will be permitted into the hospital or used therein by patients or personnel.

G. Patients messing in the mess hall will remain in their wards until notified meals are ready to be served. They will then report quietly to the mess hall.

H. Passes - absence of patients - patients must remain in the ward except when authorized to leave by the ward officer. Patients absent without authority are A.W.O.L. Patients placed in isolation wards are responsible for maintenance of isolation.

I. Ward telephone - telephones will not be used except for official business between 7:00 A.M. and 7:00 P.M. Patients will not be permitted to use phones unless authorized by ward surgeon. All unofficial calls must then be limited to 3 minutes.

J. Violation of ward rules and other regulations are punishable by disciplinary action in the case of enlisted men; or in the case of civilians, dismissed from the hospital under authority of Army Regulations.

K. Each ambulant patient is responsible for the police of his own bed and its surroundings. He will keep his person and clothing clean and neat, his hair cut, his face shaved, and shoes clean.

L. Patients are forbidden to use towels, basins, toilet articles, eating utensils or articles of clothing belonging to other patients.

DETENTION WARD

A. Patients admitted to the Detention Ward will receive care from the proper service to which they belong. The officer of the ward will notify the chief of the service concerned of the admission of such patient, and will see that all patients in his ward receive proper treatment.

B. Each patient in the Detention Ward will be seen by the enlisted attendant once each hour and at such other times as deemed necessary by the ward officer.

C. Responsibility for prisoner patients - the ward officer will assume responsibility for prisoner patients sick in the Detention Ward. If necessary he will call upon the prison officer for a guard. On departure from the hospital the ward officer will notify the medical officer of the day of prisoner patients, if any, and the O.D. will then assume responsibility for each prisoner until the return of the ward officer.

D. No patient will be admitted to or confined to the Detention Ward except on authority of a medical officer. All patients thus admitted will remain in that place, except when permitted to leave by the ward officer.

E. Medicines will not be left within the ward for self-administration, but will be administered personally by the head nurse or ward master.

F. No person except medical officers, nurses, and attendants on duty in this hospital will be permitted to enter detention wards. No person shall be permitted to loiter in the vicinity of a detention ward.

G. A careful search of all prisoner patients shall be made prior to confinement. He will not be permitted to have in his possession any articles to affect his release or other articles which may cause bodily harm. No tobacco or matches will be allowed. A daily search including all possible hiding places shall be made for such articles.

H. All attendants are forbidden to strike or maltreat patients. Any attendant using force upon a patient will be punished, or else he must prove the action was necessary to defend his own life or to prevent the escape of the prisoner.

I. The ward master while on duty will carry one set of keys to the Detention Ward. The other set will be in possession of the non-commissioned officer in charge of quarters.

J. In case of escape of a prisoner the ward officer, the post officer of the day and the prison officer will be notified at once and efforts made to apprehend him. An investigation as to the circumstances surrounding his escape is made and a written report is made to the surgeon.

REPORT FORMS

Specific report forms are necessary to record essential data concerning patients obtaining hospitalization. Some of the most common forms used are tabulated in the following outline.

Clinical outlines are intended to cover all necessary information concerning the patient to enable the medical officer to prescribe the suitable treatment. All patients entering military hospitals must have 55a and 55j blanks completed. The others vary according to needs as determined by the medical officer.

A clinical record of each patient will be started as soon as practicable after admission, using such lettered blanks of MD Form 55 as the importance and nature of the case demands. They must show an accurate, concise record of the patient's previous history, condition on admission, daily treatment while in hospital, and condition on release from the hospital. Similar records will be kept on cases sick in quarters. Records of all laboratory examinations will be attached in the proper place. In case of transfer from one ward to another the record will be completed to date, noting thereon the exact time of transfer, the ward to which transferred, and the condition of the patient. The record so completed will be delivered to the new ward. Note will be made by the transferring officer as to whether or not the patient should be returned to the original service for further study after completion by the service to which transfer is being made.

The ward master will, after proper checking of Clinical Records, send the same to the sick and wounded office, to arrive not later than 2:00 P.M. the day preceding departure of patient to duty status. All sheets of the Clinical Record will be completed, arranged in proper sequence, fastened together, and signed by the ward officer at the required time.

As soon as a diagnosis is made, it will be entered on the Clinical Record, M.D. Form 55, and the Registrar notified. Changes in diagnosis, complications, and sequelae will be noted on M.D. Form 55f and 55g and the Registrar will be furnished with a diagnosis of all cases remaining under treatment and not previously diagnosed.

ESSENTIAL REPORT FORMS USED IN ADMINISTRATION OF MILITARY HOSPITALS

Name of Report	Interval	W. D. M. D. Form No.	Number of Copies	Scope of Report	Made Out By	Distributions
Surgeon's Morning Report of Sick	Daily	AR 40-1005 71	1.	Report of Sick of the Command	Senior Medical Officer	Commanding Officer
Ward Morning Report	Daily	AR 40-590 72	2	Report of the ward accompanied by diagnosis cards;clinical records and departures to other wards	Ward Officer	Registrar Ward Files
Consolidated Ward Morning Report	Daily	AR 40-590 72a	2	Consolidated Report of all wards on one form for more rapid comparison	Registrar	The Surgeon File one
Report Sheet for Report of Sick and Wounded	Monthly on or before 5th of next month	AR 40-1025 51	4	Designation:period; component parts of the command; variations in command mean strength; patient days; outpatients, examinations, etc.	Senior Medical Officer or Registrar	Original - Corps Area Surgeon;copy-Surgeon General direct; copy-Commanding Officer of hospital;copy-Registrar's file.
Report Card (attached to Form 51)	As case is completed	AR 40-1025 52	2	Exact copy of register cards of each case reported	Registrar	Accompanies Form 51 which is sent to Corps Area Surgeon.

ESSENTIAL REPORT FORMS USED IN ADMINISTRATION OF MILITARY HOSPITALS

Name of Report	Interval	W. D. M. D. Form No.	Number of Copies	Scope of Report	Made Out By	Distributions
Patient's Property Card	Upon admission of patient to hospital	AR 40-590 75	2	Personal effects (other than money and valuables)	Admission Officer	Hospital office; duplicate to patient
Clinical Record Brief; a clinical record of each patient admitted to hospital, giving patient's history; also contains space for final disposition	Upon admission of patient to hospital and as case progresses during hospitalization	AR 40-1025 55a 55b 55c-1 55f 55g-1 55h-1 55h-2	1	Clinical Record Brief-Chief Complaint etc. Physical examination; Progress Notes; Treatment; Temperature-Treatment; Nurse's Notes; Temperature Graphic Chart	Admission Officer; Diagnosis or disposition signed by Ward Surgeon	Sent to the Registrar's Office only when patient departs. At that time, is signed by Ward Surgeon
Clinical Record Progress	Analysis of progress of case from day to day	AR 40-1025 55g	2	Always completed before transfer from one ward to another or one hospital to another	Ward Surgeon	Original-attached to clinical record; duplicate filed on transport
Index Record of patients	Upon admission of patient into hospital	AR 40-1025 52a	1	Register Index	Hospital office	Hospital office

ESSENTIAL REPORT FORMS USED IN ADMINISTRATION OF MILITARY HOSPITALS

Name of Report	Interval	W. D. M. D. Form No.	Number of Copies	Scope of Report	Made Out By	Distributions
Weekly Venereal Report	Each Saturday morning	AR 40-235 letterform	3	Resume of venereal cases occurring in the command during the week	Senior Medical Officer	Original; one to Post Commander; one to Registrar's file
Monthly Venereal Report	Monthly on or before 5th of next month	AR 40-235 letterform (see par. 6 AR 40-235)	4	Resume of venereal cases occurring in the command during month; cases treated during month; number of days lost from venereal disease; comparative rates for the components of a command in the incidence of venereal disease and the number of prophylaxes administered to the command for the month	Senior Medical Officer	To the Post Commander in triplicate for distribution to Corps Surgeon, Corps Area Commander and Surgeon General; copy to Registrar's file

ESSENTIAL REPORT FORMS USED IN ADMINISTRATION OF MILITARY HOSPITALS

Name of Report	Interval	W. D. M. D. Form No.	Number of Copies	Scope of Report	Made Out By	Distributions
Weekly Statistical Report	Weekly	AR 40-1080 86ab	3	Resume of diseases and injuries occurring in the command during the week; the number of patients admitted and discharged during week; breakdown of number of communicable diseases occurring by name and other pertinent data relative to health conditions	Registrar or Senior Medical Officer	Original to Corps Surgeon duplicate to Surgeon General direct; copy to Registrar's file
Monthly Sanitary Report	Monthly on or before the 5th of next month	AR 40-275 letterform	4	Resume of sanitary and health conditions of the command for month specified, with recommendations from the Senior Medical Officer for such changes as may improve general sanitary or health conditions of Post or command together with report of any epidemics, unusual incidents of unsanitary conditions and a report of new methods or equipment placed into operation for improvement of general sanitary conditions	Senior Medical Officer	Original and 2 copies to Post Commander for distribution to Corps Area Commander; Registrar's file

ESSENTIAL REPORT FORMS USED IN ADMINISTRATION OF MILITARY HOSPITALS

Name of Report	Interval	W. D. A.G.C. Form No.	Number of Copies	Scope of Report	Made Out By	Distributions
Daily Sick Report	Daily	AR 345-415 5	1	Where patient is first listed by his company	Company Commander and Surgeon	Company Office
Report of Death	Upon death of patient	AR 600-550 52	4	Death of patient	Surgeon or Commanding Officer	Original and 1 copy to Adj. General; 1 copy for hospital file; 1 copy to patient's Commanding Officer when death occurs away from home, station or post.

Doctor's Order Book

2-14-41 Please permit Sgt. McPhail to keep his lights on all night

Lt. D K. Smith

2-0-41

Banks & Winfield

Sulfanilamide gr XX

4-1-5 q4 for 2 days

Soda mint & tinb gr XX

9-1-5 q for 2 days

Restrict fluids to 1000 cc daily for 2 days

Then Sulfanilamide gr XX } 9-1-5 q

~ Soda mint XX } for 8 days

Jones, Paul D. ss enema H.S

Capt Lavinhor

2-15-41

Banks — keep in bed at all times

Lt. D. K. Smith

Day Report & Night Orders

9:00 A.M. Census 39

Adm - Donaldson wife/o
Disp - Hormell civ
Transf - In - Castro 5/9 Hennen 5/24
Out - None

Seriously ill McPhail TB

McPhail - M.S. 0.032 c H.M.C. No. I Tab ÷ @ 8:20 A.M.
Morph .032 + H.M.C. No. I Tabs ÷ @ 11:25 A.M.
Morph. .016 (H) + H.M.C No. I @ 2:05 P.M. for pain
M.S. .016 (H) H.M.C. No. I @ 5:00 P.M.
M.S. .032 (H) H.M.C. No. I Tabs ÷ @ 7:00 P.M.
Unable to give enema (for pain)
Unable to swallow Cascara

Peter Contardo Tr. Hyoscyamus c Sod
Citr. 4cc tid. p.c. + 8cc
bedtime

Perkins (O.P.) Atropine gr 1/150 @ 11:50 A.M. M.S.
.016 (H) @ 12:05 P.M.

M.S. - 68
Cod (H) - 25
Cod (H) - 14
H.M.C. - 20

L. Carlisle R.N.

Night Report & Day Orders

7.00 P.M. Census 41

Adm - Parrin, Robert @ 4:00 P.M.

Surg

Transfer - In -

Out

Seriously ill McPhail

McPhail - H.M.C. ē M.S. .02 @ 10:00 A.M. 12 A.M.

3:00 A.M. 1:15 A.M.

McPhail a fairly good night

Cascara ʒ ii + M.O. ʒ i @ 10:00

Hannan - Luminal gr. i @ 9:00 P.M.

H.M.C. #1 @ 1.40 Bladder irrig ē

boric acid sol.

Pt very restless moaning @ 2.45

Simpson - M.S. .016 @ 3:25 A.M. slept

Zelinski - { Na Bromide 4cc @ 8:00
{ Luminal gr i @ 4:00

Costanza - Rx 14431 4cc ē

Perkins - Hyoscyamus ē Sod Citr 8cc @ H.S.

Narcotics

M.S. .50

Cod ⓐ .25

Cod ⓑ .14

H.M.C. #1 - 15

I. B. Aron, R.N.

ADMISSION SHEET

NO.	REC. NO.	NAME	RANK	ORG.
64	241056	Bingham, Newell H.	Corp.	L. 38th Inf.
65	241058	Bonnett, Levine	Pvt	K, 38th Inf.
66	241074	Irving, Warren G.	S/Sgt.	[illegible]
67	241103	Gotke, Paul H.	Corp.	
68	2411[illegible]	Wilson, Kane E.	Sgt.	38th Inf.
69	241123	Peterson, John H.	2nd Lt.	Reg. Hq.

DISCHARGE BOOK

SOURCE	DATE	DIAGNOSIS	DISP.	DATE
Litter	1-28-41	Fracture	Transf.	1-29-41
Walked	1-29-41	Kidney Stone	Duty	1-31-41
[illegible] 20/60	1-30-41	Scabies	Duty	2-12-41
T.O	2-2-41	Cystitis	Dischg	2-5-41
Emer. Litter	2-3-41	Crushed Hand.		
Litter	2-3-41	Skull Fracture	Died	2-3-41

Narcotic Book

Morphine 008

Date	Name	Amt	Time	Bal	Officer	Nurse
2-[illegible]	McPhail	.032	10:[illegible] PM	5	Capt [illegible]	H Hunter
2-15-41	"	.032	3:30 PM	–		C Hunter
2-15-41	Rec'd from Pharmacy 40 tab = 41					
2-15-41	McPhail	.032	7:05AM	37	Capt. Leuchner	L Ryp R.
2-15-41	Prause	.016	8:00AM	35	" "	R. Kuhree
2-15-41	McPhail	.032	6.30PM	27	"	
2-15-41	" "					
2-15-41	Prause	.0[illegible]	8:12 PM	25	"	H Hunter
2-[illegible]-41	McPhail	.032	[illegible] PM	21	–	H Hunter

Codeine (oral) 21
0.02

Date	Name	Amt	Time	Bal	Officer	Nurse

HMC #1 .35

Date	Name	Amt	Time	Bal	Officer	Nurse

Codeine (Hypo) 47
0.032

Date	Name	Amt	Time	Bal	Officer	Nurse

Paregoric 55

Date	Name	Amt	Time	Bal	Officer	Nurse

Lt Hickey 69

Date	Name	Amt	Time	Bal	Officer	Nurse

PUBLIC PROPERTY

PUBLIC PROPERTY

I. Introduction.
  A. Subject covers wide list of supplies and property for entire army.
  B. Standardization of methods and business principles.
  C. Responsibility of all personnel of Medical Department for full usage value to be obtained from all supplies.
  D. Economical use.
  E. Surplus and shortages.
  F. Care in storage of new supplies - deplete old stock first.
  G. Normal amount of supplies requisitioned.

II. Accountability and Responsibility.
  A. Accountability devolves upon the person who has property in possession, or for issue and is required to maintain property account thereof.
  B. Responsibility of property is delegated to that person who holds property on memorandum receipt.
  C. General responsibility on all officers concerned.
  D. Sales articles in salesrooms are inventoried monthly.
  E. When inventory does not tally, over, short and damage reports, and reports of survey are prepared.
  F. Surgeon of each station renders a report to Surgeon General on June 30th and December 31st of money value of Medical Department supplies.

III. Supply Officer: is designated for each branch of service for each station and maintains property accountability records.

IV. Property Records.
  A. Complete record of all articles of Government property under accountability is made on stock record forms, showing quantities on hand, on order, received, or issued. This is kept on W.D. Q.M.C. Form 5? or on authorized modification.
  B. In order that location and quantity of property may at all times be known, there is kept at each organization supply office a general record or account of such property.

V. Accounting of property in time of war - in time of war accounting of property of all kinds in hand and issued in theater of operations ceases. When organization passes out of theater of operations, the Commanding Officer has complete inventory made and a new account prepared.

VI. Classification of Property and Equipment. (See first two pages of Medical Supply Catalogue).
  A. Expendable property consists of articles consumed in maintenance and upkeep of the service; such is dropped from accountability upon expenditure.
  B. Non-expendable property includes all other articles. Such property cannot be dropped from accountability without formal transfer or property voucher.

Tableware, kitchen utensils, china and glassware of Q.M.C. issue, when lost or damaged through carelessness, are charged to those responsible for breakage. Allowance for breakage for china and glassware, 20% annually, 5% quarterly, of total value of allowance to that organization. Such supplies are dropped from accountability upon certificate of responsible officer. Articles lost or stolen should be surveyed and responsibility fixed therefor.

VII. Branch Responsibility.

A. Medical Department responsible for procurement, storage and issue of medical, dental and veterinary supplies and equipment.

B. Surgeon of each station or command designates one Medical Department officer or Medical Supply officer, who becomes the responsible officer for Medical Department Supplies at that station or command.

C. The classification, nomenclature, and item numbers prescribed in Supply Table of Medical Department, are employed in preparing all papers pertaining to standard medical items.

VIII. General Requisitions.

A. Requisition for sufficient equipment pertaining to any of the supply branches, are made on W.D. Q.M.C. Form 400.

B. Organizational equipment should be obtained through organizational supply officer, who obtains these through station supply officer.

IX. Requisition for Medical Supplies.

A. Requisitions are prepared by Medical Supply Officer of the station after obtaining from the chief of each service of the Medical Department at his station, a list of the supplies required for the period covered by the requisition.

B. Requisitions are submitted in triplicate, only one form being forwarded.

C. When necessary, department and corps area surgeons and Commanding Officers of general hospitals are authorized to forward emergency requisitions for biological products only direct to their issue depots, one copy of the requisition showing action taken, being forwarded to The Surgeon General.

D. All requisitions are numbered serially, a new series being started at the beginning of each year.

E. Each requisition signed by medical supply officer and signed by the surgeon, or in case of general hospital, the Commanding Officer.

F. Semi-Annual Requisitions. From all camps, posts and stations these are submitted March 31st and September 30th, and include all standard items (except deteriorating items) and blank forms for the period covered.

G. Quarterly Requisitions. These are submitted on March 31st, June 30th, September 30th and December 31st. One requisition is submitted for standard items and another for non-standard items required during the quarter covered. This requisition covers only deteriorating items: marked (1) in the notes column.

H. Emergency Requisitions. These are submitted only when urgently needed and are accompanied by a letter of transmittal signed by the surgeon, giving full details as to the emergency. Such biological products as may be required in an emergency are obtained by emergency requisition forwarded in the same manner. If the situation is sufficiently urgent local purchases may be made and full report as to the necessity for such action forwarded.

I. Action on Requisitions.

1. Requisitions are forwarded in triplicate to the service command or department surgeon, who after acting upon the requisition, returns one copy to the requisitioning office (showing thereon the depot of issue and amounts approved), forwards one copy to the depot designated to make the issue, and retains one copy for his own files.
2. All copies for non-standard items and emergency requisitions, except for biological products authorized for issue, are forwarded by service command surgeon by indorsement to the Surgeon General.

General - The Medical Department Supply Catalog, containing a list of the standard items of medical supplies which are stored and issued by the Medical Department, is published for the information and guidance of all concerned. In the appendix, may be found a list of the contents of assembled cases, chests, etc., used by the several components of the Medical Department at stations and in field service. Contained therein are several formulae of pharmaceutical preparations, also certain War Department and Medical Department blank forms.

Classification - Items are classified according to function or commodity. The first digit of the item indicates the class to which the item pertains. Classes and subclasses are as follows:

Class 1.	10010-15440	Drugs, chemicals, biological stains.
	15900-18280	Biological products.
Class 2.	20010-20420	Surgical dressings.
Class 3.	30010-35590	Surgical instruments.
	36010-39910	Surgical appliances, miscellaneous diagnostic instruments and surgical supplies.
Class 4.	40010-44910	Laboratory equipment and supplies.
Class 5.	50020-57030	Dental equipment and supplies.
Class 6.	60020-61730	X-Ray equipment and supplies.
Class 7.	70000-71012	Furniture.
	71020-71390	Physiotherapy equipment.
	71510-71780	Hospital linen and bedding.
	72010-74320	Mess equipment and supplies.
	74510-74955	Cleaning and preserving equipment and supplies.
	75020-76700	Stationery and miscellaneous office equipment and supplies.
	77010-79550	Miscellaneous hospital equipment and supplies.
Class 8.	80010-81413	Veterinary equipment and supplies.
Class 9.	91010-99630	Field equipment and supplies.

3. Explanatory remarks.

a. Expendable items within the meaning of AR 35-6620 are indicated by the letter "X" in the column following the item number.

b. Controlled items, as contemplated by AR 20-35, are indicated by the sign "C", in the column following the item number. Requests for the disposition of such items should state:

Classification under paragraph 5, AR 35-6640.
Date of receipt and source.
Manufacturer, model, serial number, etc.
Nature and manner of unserviceability.
Estimated cost of repair. (See AR 40-1705, par.5c).

c. The numerals entered in the column following the item number indicate the following:

(1) Considered deteriorating.
(2) Refer to appendix for description of item, formula, contents of case, etc.
(3) Requisitions should state manufacturer, type, description, size, and serial number of item or part required.
(4) Requisitions should state voltage, correct DC or AC (If AC, cycle and phase).
(5) Item will not be issued to hospitals smaller than 50 beds.

d. The fact that allowances are shown for expendable items will not affect existing instructions where issues are controlled by money credits to individual stations. These allowance figures are given as a guide for use where experience in past issues is not available.

e. Allowances in classes other than Class 5 (Dental equipment and supplies), Class 8 (Veterinary equipment and supplies), and Class 9 (Field equipment and supplies), represent the average six month's use for posts having military strengths of 1,000, 5,000, and 20,000, including any requirements of the Dental and Veterinary services (see subparagraphs g and h for special instructions relative to supplies for these services). Translated into bed capacities, these strengths may be regarded as representing 50,250 and 1000, respectively. In figuring allowances, when the proportion results in a fractional part of a number the fractional part will be considered as 1.

(1) Requisitions other than those from general hospitals will show separately, military, civilian, and animal strength, but the sum of the first two will be used to compute allowances. Stations having a strength less than 1,000 will figure their allowances in proportion to their size from the allowance shown for a post of 1000. For example, a post having 500 strength would be allowed 500/1000 or 1/2 of 200 in the case of item 70090. Stations having a strength greather than 1000, but less than 5000, will figure their allowances in proportion to their size from the allowance shown for a post of 5000.

(2) General hospitals of smaller or larger bed capacity than 1000 will figure their allowances in proportion to that shown for a 1000 bed General Hospital in the 20,000 column. For example, in determining allowances, a general hospital having 250 beds would be allowed 250/1000 or 1/4 of 5000 in the case of item 70090.

f. Allowances for items of dental equipment and supplies (Class 6) are based upon the number of dental officers on duty at posts.

g. Allowances for items of veterinary equipment and supplies (Class 8) are based upon an animal strength of 1000.

h. The letters "SG" in the allowance columns indicate that prior authority must be obtained from The Surgeon General to requisition. The necessity for such items will be clearly stated.

i. The letter "L" in the allowance columns opposite certain items in Class 4 indicates that issues, in such quantities as may be required, will be limited to stations doing laboratory work. The issue of items so designated to stations other than these will be made only upon prior authority from The Surgeon General and the need for such items will be clearly stated.

j. The letter "R" in the allowance columns opposite certain items indicates those which will be issued only to complete an assembled chest or case, or to replace a part pertaining to another item.

k. A row of dashes in the allowance columns indicates that issues of the item will be made until existing stocks are exhausted.

l. The prices quoted herein will govern in all cases of charges on pay rolls, sales, reports of survey, inventory, and inspection reports, transfers, inventories, requisitions, shipping tickets, and other papers in which prices are used. In the case of sales or transfers to other services, branches of the War Department, the National Guard and civilian components of the army, 3 per cent of the value of the supplies as listed, to cover cost of packing and handling, will be charged.

m. The letters "DL" in the allowance columns indicate that issues, in such quantities as may be required, will be limited to Central Dental Laboratories or Dental Laboratories at general hospitals and approved station hospitals.

4. Non-standard items.- Replacement and spare parts for standard items are not usually listed in this catalog and should be secured on quarterly non-standard requisition in the manner directed by AR 40-1705 and current circular letters issued from this office from time to time.

5. Errors in this catalog should be promptly reported to The Surgeon General.

Form 16a
Medical Department, U.S. Army

ISSUE SLIP
EXPENDABLE MEDICAL PROPERTY

To the Medical Supply Officer:
Please issue the following for use in:
Ward- New Hosp

ITEM	ARTICLES	UNIT	QUANTITIES ON HAND	QUANTITIES RE-QUIRED
45320	Ledger 10 1/2 x 14	@	1	2
48220	Soap toilet	carton	1	5

I certify that I have personally verified the quantities on hand, that the amounts shown are correct, and that the quantity requested is necessary to meet actual requirements.

Lt. S. J. K. Schmid
Officer in Charge

Lt. V. Oglethorpe
Medical Supply Officer

Sgt. P. [illegible]
Wardmaster

4-21-41

INSTRUCTIONS

1. This request will be made out and signed by the officer in charge of the department of the Hospital for which the articles are needed. The names of the articles will be written as they appear in the Medical Department Supply Catalogue.
2. The slip will be completed by the receipt of the Wardmaster, who will insert the date. It will then be filed at the Medical Supply Office.

Form 16b
Medical Department, U.S. Army

ISSUE SLIP
NONEXPENDABLE MEDICAL PROPERTY

To the Medical Supply Officer:
Please issue the following for use in:
Ward- New Hosp

ARTICLES	QUANTITY
42250 Bed Hospital	5
4355? Mattress innerspring	5
47551 Mattress Cover	5

Lt. S. J. K. Schmid
Officer in Charge

Lt. V. Oglethorpe
Medical Supply Officer

Sgt. [illegible]
~~Wardmaster~~

10-24-41

INSTRUCTIONS

1. This request will be made out and signed in duplicate by the officer in charge of the department of the hospital for which the articles are needed. The names of the articles will be written as they appear in the Medical Department Supply Catalogue.
2. Both the original and the duplicate slips will be completed by the receipt of the Wardmaster, who will insert the date. The original will then be filed at the Medical Supply Office, and the duplicate returned to the officer who made out the request for file, with his retained memorandum receipt.

Form 16c
Medical Department, U.S.Army

CREDIT SLIP

NONEXPENDABLE MEDICAL PROPERTY

To the Property Officer: The following articles no longer needed are turned in from

Ward - New Hosp

ARTICLES		QUANTITIES
7364	[illegible]	1
42650	Urinal metal	5

Capt [illegible] Smith
Officer in Charge

Approved Capt [illegible]
Property Officer

Received into storage: Sgt [illegible]
Storekeeper

Date

INSTRUCTIONS

1. This list will be made out and signed in duplicate by the officer in charge of the department of the hospital where the property has been in use. The names of the articles will be written as they appear in the supply table Manual for the Medical Department.
2. If the property to be turned in is unserviceable from any cause other than fair wear and teat in the service, a statement will be attached showing what action has been taken to fix responsibility.
3. Both the original and the duplicate slips will be completed by the receipt of the storekeeper, who will insert the date. The original will then be returned to the officer turning in the property, for file with his retained memorandum receipt, and the duplicate will be filed at the Medical Property Office.

Form 16d
Medical Department, U.S. Army

EXCHANGE SLIP

NONEXPENDABLE MEDICAL PROPERTY

To the Property Officer: Please exchange serviceable property for the following from

Ward Newhosp

ARTICLES		QUANTITIES
[illegible]	[illegible]	1
[illegible]	Can [illegible] 3 3 gal.	3

Capt. [illegible] Smith
Officer in Charge

Exchange Approved: __________
Property Officer

Received serviceable articles:

Date __________ Wardmaster

INSTRUCTIONS

1. This request will be made out and signed by the officer in charge of the department of the hospital for which the serviceable property is needed. The names of the articles will be written as they appear in the Supply Table Manual for the Medical Department.
2. If the property to be turned in is unserviceable from any cause other than fair wear and tear in the service, a statement will be attached showing what action has been taken to fix responsibility.
3. The slip will be completed by the receipt of the Wardmaster, who will insert the date. It will then be filed at the Medical Property Office.

EXPENDABLE SUPPLY LIST

Surgical Supplies Class III

Item No.	Item	Unit	Unit Price	Issued
31080	Catheter, urethral rubber 16 F	ea.	.09	
33811	Needle, intestinal size 2 3/4"	ea.	.04	
36197	Str. Bandage, rubber 2 1/2	ea.	.65	
40630	Bottle reagent, alcohol	ea.	.20	
43955	Slide Micro, 75 x 38, MM, 1/2 gr.	ctn.	.50	

Stationery and Miscellaneous Office Equipment and Supplies

Item No.	Item	Unit	Unit Price	Issued
75730	Inkstand	ea.	.11	
75930	Pad, desk	ea.	.25	

NON-EXPENDABLE SUPPLY LIST

Hospital Supplies Class VII

Hospital Linen and Bedding

71550	Bedspread	ea. 2.84
71720	Sheet	ea. .90

Mess Equipment and Supplies

72170	Soup bowl, enamel ware	ea. .06
72775	Dishwashing machine, small, electric	ea. 479.00

Cleaning Equipment and Supplies

74620	Bucket	ea. .75
74700	Mop Handle	ea. .19

MEDICAL SUPPLY OFFICE
Brooke General Hospital
Fort Sam Houston, Texas

FS/jen

March 21, 1941.

M/R No. 1-M:

Ward No. 1, New Hospital:

CONSOLIDATED MEMORANDUM RECEIPT
NO. 1-M

25	each	70050	Bed, hospital
18	each	70060	Bed, adjustable
1	each	70330	Carriage, wheeled
10	each	70605	Lamp, adjustable for bed
200	each	71720	Sheet
68	each	71770	Towel, bath
1	each	72020	Egg beater, dover
1	each	77360	Can, G.I., 33 gallon

NOTE: This memorandum receipt consists of 1 page, and cancels all other memorandum receipts, credit and debit slips, of previous dates. Please sign and return the original copy to the Medical Supply Officer at the earlist practicable date. Do not make any alterations or erasures on this receipt.

Joseph H. Padock
Joseph H. Padock,
Major, Medical Corps,
Medical Supply Officer.

I acknowledge to having received the above listed property and will be responsible for same, until turned over to the Medical Supply Officer, unless otherwise relieved by competent authority.

Dwain K. Smith
Dwain K. Smith,
1st Lieut., Medical Corps.

MANUAL OF MATHEMATICS

THE ROMAN SYSTEM OF NOTATION

(1) Definition: The Roman System of Notation is one of the oldest systems of notation used. It is composed of letters instead of numbers.

(2) The letters and what they represent in the Arabic System (our common, ordinary system of numbers) are:

Roman Numerals		Arabic Numerals
I	-	1
V	-	5
X	-	10
L	-	50
C	-	100
D	-	500
M	-	1000

(3) Rules of the Roman System of Notation:

1. Smaller letter to the right of a larger one means - ADD.
2. Smaller letter to the left of a larger one means - SUBTRACT.
3. Never use more than three of the same letters in a row.

EXAMPLES

Rule 1. To write 6 in the Roman System, the smaller letter is placed to the right of the larger letter.

$5 + 1 = 6$ VI = 6

Rule 2. To write 4 in the Roman System, the smaller letter is placed to the left of the larger letter.

$5 - 1 = 4$ IV = 4

Rule 3. To write 4 in the Roman System, you cannot add up four I's.

IIII = 4 (incorrect) IV = 4 (correct)

	1000	400	90	2	
1492	M	CD	XC	II	MCDXCII
	1000	900	40	2	
1942	M	CM	XL	II	MCMXLII

FRACTIONS

(1) Definition: A fraction is any part of one unit (any part of a whole).

(2) Types of fractions: (a) Common fractions.
(b) Decimal fractions.

COMMON FRACTIONS

A common fraction is made up of two numbers or terms and a dividing line. The top number is called the numerator, and the bottom number is called the denominator.

Example:

Numerator:	2
Dividing line:	___
Denominator:	3

There are four processes which can be carried out with fractions. These are the same ones which can be done with whole numbers:

1. Addition.
2. Subtraction.
3. Multiplication.
4. Division.

The addition of fractions when the denominators of all are the same.

To add fractions with the same denominators, add only the numerators (top numbers) - the denominator (bottom number) of the answer is the same as those of the other fractions.

Example: $\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$

The addition of fractions when the denominators are not the same.

To add fractions with different denominators, the fractions must be changed so that all the denominators are the same. To do this, the denominators are multiplied together to find a COMMON DENOMINATOR - that is, a number which can be divided evenly by every one of the original denominators. Then each fraction is converted to a new fraction with this common denominator as its denominator. To do this, each denominator is divided into the common denominator. Then multiply each numerator by the number of times its denominator goes into the common denominator. The results obtained from these multiplications are used for the new numerators. From here on proceed as in the addition of fractions when the denominators of all are the same.

Example: $\frac{1}{2} + \frac{1}{3} + \frac{1}{4} =$

$$\frac{12}{24} + \frac{8}{24} + \frac{6}{24} = \frac{26}{24} = \frac{13}{12} = 1\frac{1}{12}$$

<u>Subtraction of common fractions when the denominators are the same.</u>

Subtract the numerator of the smaller fraction from the numerator of the larger fraction. The denominator stays the same.

Example: $\frac{3}{4} - \frac{1}{4} = \frac{2}{4}$

<u>Subtraction of common fractions where the denominators are not the same.</u>

In the same way as in adding, convert each fraction into a new one so that all fractions have the same denominators. Then subtract the smaller numerator from the larger numerator and place the result over the common denominator.

Example: $\frac{1}{2} - \frac{1}{3} = \frac{3}{6} - \frac{2}{6} = \frac{1}{6}$

<u>The multiplication of common fractions.</u>

Multiply the numerators together and place the result as a new numerator. Then multiply the denominators together and place the result as a new denominator.

Example: $\frac{2}{3} \times \frac{3}{8} \times \frac{4}{5} = \frac{24}{120}$ or $\frac{1}{5}$

<u>The division of common fractions.</u>

Invert (turn upside down) the second fraction - the one which is to do the dividing. Then proceed as in multiplication.

Example: $\frac{1}{3} \div \frac{1}{9} = ?$

$$\frac{1}{3} \times \frac{9}{1} = \frac{9}{3} = 3$$

DECIMAL FRACTIONS

Definition: A part of a unit expressed as a number containing a decimal point.

Thousands	1000.	$1000.00	
Hundreds	100.	100.00	
Tens	10.	10.00	
Units	1.	1.00	
Tenths	.1	.10	a dime
Hundredths	.01	.01	a cent
Thousandths	.001	.001	a mill
Ten Thousandths	.0001	.0001	a tenth of a mill

IN WRITING DECIMAL FRACTIONS, ALWAYS PLACE THE DECIMAL POINTS IN A VERTICAL COLUMN.

The first place to the right of the decimal point is called TENTHS
The second place to the right of the decimal point is called HUNDREDTHS
The third place to the right of the decimal point is called THOUSANDTHS
The fourth place to the right of the decimal point is called TEN THOUSANDTHS.

Units	Decimal Pt.	Tenths	Hundredths	Thousandths	Ten Thousandths
1	.	2	3	4	5

ADDITION OF DECIMAL FRACTIONS:

Place the decimal points in a vertical column and then place the decimal point in the answer below the last decimal point.

$$\begin{array}{r} .123 \\ .234 \\ + \underline{.345} \\ .702 \end{array} \qquad\qquad \begin{array}{r} 1.076 \\ .324 \\ + \underline{.1} \\ 1.500 \end{array}$$

ALWAYS PLACE THE SIGN TO DENOTE WHAT TYPE OF PROBLEM YOU ARE WORKING TO AVOID ERRORS.

SUBTRACTION OF DECIMAL FRACTIONS.

Place the smaller number under the larger, keeping all decimal points in a row and subtract.

```
    .903            15.962
  - .75               .453
    .153            15.509
```

MULTIPLICATION OF DECIMAL FRACTIONS.

Multiply the same as for a whole number, then point off from right to left as many decimal places in the answer as there are in the problem

```
     1.706             .309
  x   .003           x .790
   .005118           .244110
```

DIVISION OF DECIMAL FRACTIONS.

Count the number of places to the right of the decimal point in the number that is to do the dividing. Move the decimal point in the number that is to be divided up the same number of places to the right. Show this new site for the decimal point by an inverted V, (Λ). Place the answer's decimal point directly over the inverted V, (Λ). Then proceed as in regular long division, ignoring all decimal points; being careful to keep each number in the answer over its corresponding one in the problem.

10.695 ÷ 2.3 = ?

```
                                     4.65
                             2.3Λ)10.6Λ95
                                  9 2
    2.3) 10.695                   1 4 9
                                  1 3 8
                                    1 1 5
                                    1 1 5
```

TO CHANGE A COMMON FRACTION TO A DECIMAL FRACTION

Divide the numerator by the denominator.

```
              0.5
    1      2) 1.0
    -
    2
```

Common fraction	=	Decimal fraction
$\frac{1}{2}$	=	.5

PERCENTAGE
(%)

Definition:

Percentage means "Parts per Hundred". The Percent sign is - %. Wherever you see this sign, substitute the one word "HUNDREDTHS" for it. The percent sign - % - is nothing more than an abbreviation for the word "HUNDREDTHS", just as "Mr." is the abbreviation for the word "Mister".

Example: 10% is 10 hundredths
10 hundredths written as a decimal fraction is .10, or written as a common fraction, is $\frac{10}{100}$

Problem: Take 10% of 100 apples.
Solution: To work with % you always multiply. Thus:

.10 x 100 apples = 10 apples

$$\begin{array}{r} 100 \text{ apples} \\ \times \quad \underline{.10} \\ 000 \\ \underline{100} \\ 10.00 \text{ apples} \end{array}$$

Scale to Study and Understand

1% = 1 hundredths = .01
75% = 75 hundredths = .75
.5% = .5 hundredths =.005
$\frac{1}{2}$% =.5% = .5 hundredths = .005

There are many ways of writing any given percent. For example, take 1%. 1% is equal to 1 hundredths - 1 hundredth written as a common fraction, is $\frac{1}{100}$.
1 hundredth written as a decimal fraction is .01
The common fraction $\frac{1}{100}$ means "1 part out of 100".

In place of the words "part out of", we can use any of the following, thus:
1. 1 to 100
2. 1 - 100
3. 1 of 100
4. 1 in 100

Now to list every way possible to write 1%, we have the following:

1. 1%
2. 1 hundredth
3. .01
4. $\frac{1}{100}$

5. 1 part out of 100
6. 1 to 100
7. 1 in 100
8. 1 of 100
9. 1 - 100

The important ones to learn and to be able to write for any given percent are numbers 1, 3 and 9.

Example:

Number 1. - 75%
Number 3. - .75
Number 9. - 75 - 100

Number 1. - .1%
Number 3. - .001
Number 9. - .1 - 100 or 1 - 1000

CONVERSIONS OF TERMS USED TO DESCRIBE STRENGTH OF SOLUTIONS

Convert:

A. 1-100 into percent.
$$1\text{-}100 = \frac{1}{100} = .01 = 1\%$$

B. 1-500 into percent.
$$1\text{-}500 = \frac{1}{500} = .002 = .2\%$$

C. $1\text{-}1500 = \frac{1}{1500} = .00066 = .066\%$

THE METRIC SYSTEM

1. The Metric System is an accurate way to make measurements used the world over. One can weigh a pound of butter and describe its weight in ounces and pounds; also one can weigh butter in Grams and Kilograms. (Metric System). One can measure the length of a piece of lumber and describe it in inches, feet, or yards; also one can measure it in millimeters, meters and kilometers. (Metric System). One can measure out a bottle of milk and describe it in fluid ounces and quarts; also one can measure it in milliliters, cubic centimeters and liters. (Metric System). The Metric System is used in the army to measure all medicines. Based upon the decimal system, it is very much like our coin system.

2. THE UNIT OF WEIGHT IS THE "GRAM".
THE UNIT OF LENGTH IS THE "METER".
THE UNIT OF CAPACITY IS THE "LITER".

3. Sub-divisions of the units are expressed by the adding of following terms:

Deci - means 1/10 of a unit, i.e., a decigram, decimeter, deciliter.
A decigram is one-tenth of one Gram.
Centi- means 1/100 of a unit, i.e., centigram, centimeter, centiliter.
A centimeter is one-hundredth of a Meter.
Milli- means 1/1000 of a unit, i.e., milligram, millimeter, millileter.
A milliliter is one-thousandth of a liter.

4. Multiples of the units are expressed by adding the following terms:

Deka - means 10 times a unit, i.e., Dekagram is 10 Grams.
Hecto- means 100 times a unit, i.e., Hectogram is 100 Grams.
Kilo - means 1000 times a unit, i.e., Kilogram is 1000 Grams.

5.

Length	Volume	Weight	
Kilometer, Km.	Kiloliter, Kl.	Kilogram, Kg.	1000.0
Hectometer	Hectoliter		100.0
Dekameter	Dekaliter		10.0
Meter, M.	Liter, L.	Gram, Gm.	1.0
Decimeter	Deciliter		0.1
Centimeter, cm.	Centiliter		0.01
Millimeter, mm.	Milliliter, ml.	Milligram,mg.	0.001

NOTE: Memorize in their correct relationship only the words and numbers underlined in the above scale.

6. How did the inventors of the Metric System decide on just how long a "Meter" should be?

They measured one-fourth (1/4) of the distance around the earth (through both poles) and sub-divided that length into 10 million parts. One of these 10 million parts was the length selected to be called "one meter".

How did they decide the size of a "liter"?

They took one-tenth (1/10) of a "meter" and built a box, 1/10 of a meter long, 1/10 of a meter high, 1/10 of a meter wide. They said, this shall be the unit of capacity and called it "one liter".

How did they decide on just how much a gram should weigh?

They filled the box called "one liter" with plain water. They then removed (1/1000) one-thousandth part of that liter of water and weighed it. The weight of this small amount of water was chosen as "one gram". Therefore, since 1/1000 of a "liter" of water weighs one "gram"; then one "milliliter" weighs one "gram".

7. If we build a box 1 centimeter long, by one centimeter high, by one centimeter wide, it would contain "one cubic centimeter". (c.c.). We know this is so,for we have the rule:

"length" times "width" times "height" equals "cubic contents".
l x w x h = cubic contents.
1 cm. times 1 cm. times 1 cm. equals 1 cubic centimeter (c.c.).

This box filled with water contains 1 cubic centimeter (c.c.) of water and it weighs "one gram". Thus, since one "milliliter" of water weighs"one gram", and since "one cubic centimeter" of water weighs "one gram,then"one milliliter" of water is equal to "one cubic centimeter" of water for both are equal to the same thing, and things equal to the same thing are equal to each other. Thus, we can use "cubic centimeter" in place of the term "milliliter" and vice versa.

8. METRIC SYSTEM EQUIVALENTS

a.	LENGTH	1 meter	=	39 inches
		25 millimeters	=	1 inch
		2.5 centimeters	=	1 inch
		1 Kilometer	=	5/8 mile
b.	WEIGHT	1 kilogram	=	2.2 pounds or 2 1/5 lbs.
		30 grams	=	1 ounce
		1 gram	=	15 grains
c.	CAPACITY	1 liter	=	1000 milliliters or cubic centimeters
		30 c.c.	=	1 fluid ounce
		1 c.c.	=	15 minims (drops)

9. The Metric System is used in the army to measure medicine doses. In civilian life the pharmacists and most doctors use the "Apothecary System".

APOTHECARIES SYSTEM:

a. LIQUID MEASURE

60 minims, m (drop)	= 1 fluidrachm
8 fluidrachms	= 1 fluidounce
16 fluidounces	= 1 pint
2 pints	= 1 quart
4 quarts	= 1 gallon

b. WEIGHT MEASURE

437 grains (gr.)	= 1 ounce
16 ounces	= 1 pound

1 grain is the weight of 1 minim of water.

10. APPROXIMATE MEASURES

1 glassful	= 8 ounces (240 cc.)
1 teaspoonful	= 4 cubic centimeters (cc.) or 1 fluidrachm
1 tablespoon	=16 cc. or 4 fluidrachms.

THE ARMY GLUCOSE FLASK

Glucose (sugar) dissolved in sterile water is frequently administered to surgical patients. Whenever crystals are dissolved in water, the resulting mixture is called a "SOLUTION". Thus, when glucose crystals are dissolved in water we call the mixture a "glucose solution". The army furnishes the medical corps with glucose in the form of a solution and not as solid crystals of sugar. The solution comes in but one strength. It is half glucose and half water, thus it is 50% glucose and 50% water. This half and half mixture of glucose and water comes in rubbered stoppered bottles, each containing 50 cubic centimeters of the solution. The bottle is prepared by placing into it 25 grams of glucose crystals and then adding sterile water to the 50 cubic centimeter mark, thus producing 50 cubic centimeters of a 50% glucose solution.

PREPARATION OF SOLUTIONS

1. GLUCOSE SOLUTIONS.

Prepare 1000 cc. or grams of 5% glucose solution using the army flasks of 25 grams of glucose in 50 cc. of solution.

The solution is made up of water and glucose. The first step is to find out how much glucose is in 1000 cc. of 5% glucose solution.

Use the formula - % x Gm or cc = Active agent

If we take 5% of 1000 Gm or cc we will have the amount of glucose

Thus: 5% x 1000 Gm or cc = 50 grams of solid glucose crystals needed to make up the desired solution.

Where can we get 50 grams of glucose from? It must come from the flasks furnished by the army. Each flask contains 50 cc. of 50% glucose; or, expressed in grams, 25 grams of glucose. To get the needed 50 grams of glucose we must take 2 flasks. Therefore, we take a liter (1000 cc.) container, pour into it 2 of the army flasks, giving us in the liter container 50 grams of glucose in 100 cc. of solution. (Each army flask contains 50 cc. of solution.) If we now fill the liter container up to the 1000 cc. mark with sterile water, we will have our final solution. Thus, by adding 900 cc. of sterile water (for we have in the container 100 cc. of solution when we add the 2 army glucose flasks), we will have 1000 cc. of 5% glucose solution.

2. SALT SOLUTIONS - such as Silver Nitrate ($AgNO_3$), Potassium Permanganate ($KMNO_4$), Argyrol, Procaine, Saline Solutions.

a. Problem No. 1:

Prepare 1000 cc. of 1-1000 solution of $AgNO_3$, using a 10% stock solution.

THE FIRST STEP IS TO CHANGE THE 1-1000 to percent.

1-1000 = 1/1000 = .001 = .1%

FORMULA: % x $\begin{matrix}\text{Gm.}\\\text{or}\\\text{cc.}\end{matrix}$ = Active Agent.

.1% of 1000 $\begin{matrix}\text{Gm.}\\\text{or}\\\text{cc.}\end{matrix}$ = THE AMOUNT OF SOLID CRYSTALS OF $AgNO_3$ in the solution to be made.

.001 x 1000 $\begin{matrix}\text{Gm.}\\\text{or}\\\text{cc.}\end{matrix}$ = 1 gram of solid $AgNO_3$ Crystals

Now the problem is "How many cc. of our stock solution must we take to give the needed 1 gram of $AgNO_3$ Crystals?"

The stock solution is a 10% solution, and an unknown amount of it contains 1 gram of solid $AgNO_3$ crystals. Therefore, we can write the following equations:

% x $\begin{matrix}\text{Gm}\\\text{or}\\\text{cc}\end{matrix}$ = Active agent

10% x ?cc = 1 gram of $AgNO_3$

.10 x ?cc = 1 gram

$?cc = \frac{1}{.10}$

?cc = 10

?cc = 10 cc.

Therefore 10 cc. of the 10% stock solution contains 1 gram of solid $AgNO_3$ crystals.

Thus, we take 10 cc. of the stock solution and add 990 cc. of water to make up 1000 cc. of a 1-1000 (.1%) solution of $AgNO_3$.

b. Problem No. 2:

Prepare 250 cubic centimeters of 1% Procaine (Novocaine). using 2 1/2 gram charts

(Procaine is a colorless crystal, which, dissolved in sterile water, produces the Procaine Solution.) Since procaine solutions quickly lose their strength on standing, they are usually not prepared until they are actually needed. The pharmacy will weigh the procaine crystals in small amounts and wrap them in small pieces of cellophane or paper envelopes. These small packages of crystals are called "CHARTS". The charts can be prepared in any desired weight.

$$\% \times \begin{matrix}\text{cc.}\\ \text{or}\\ \text{Gm.}\end{matrix} = \text{A.A.}$$

$$1\% \times 250 \begin{matrix}\text{cc.}\\ \text{or}\\ \text{Gm.}\end{matrix} = \text{A.A.}$$ (The amount of solid crystals of procaine needed for the solution to be prepared.)

$.01 \times 250$ Gm. = 2.5 Gm. of solid procaine crystals.

Therefore, take 1 chart (2.5 Gm.) of procaine crystals and add sterile water to a total volumn of 250 cc. This will make 250 cc. of 1% novocaine.

c. Problem No. 3:

Prepare 60 cc. of 1/2% procaine solution using 1 gram charts.

$$\% \times \begin{matrix}\text{c.c.}\\ \text{or}\\ \text{Gm.}\end{matrix} = \text{A.A.}$$

$1/2\% \times 60$ cc. = A.A.

$.5\% \times 60$ cc = A.A.

$.005 \times 60$ Gm. = .3 Gm. of procaine crystals needed to prepare the 60 cc. of 1/2% solution.

Thus, less than 1 chart of procaine crystals is needed. Since we have no way to accurately measure out a part of a chart, it is necessary to take a whole chart and make the entire chart into a 1/2% solution.

$$\% \times \begin{matrix}\text{cc.}\\ \text{or}\\ \text{Gm.}\end{matrix} = \text{A.A.}$$

$1/2\% \times$?cc. = 1 Gm. of active agent (procaine crystals) dissolved in an unknown number of cubic centimeters of sterile water (?cc.) will produce a 1/2% solution.

$.005 \times$?cc. = 1 Gm.

$$?\text{cc.} = \frac{1}{.005}$$

?cc = 200

? = 200 cc.

Thus, 1 gram of procaine crystals dissolved in 200 cc. of sterile water produces 200 cc. of 1/2% procaine solution.

CONVERSION OF GRAINS TO GRAMS

Convert 1/4 grain to grams.

15 gr. = 1 gram
1 gr. = 1/15 gram (1/15 = .067)
1 gr. = .067 Gm.
1/4 gr. = 1/4 x .067 Gm. = .016 Gm.
1/4 gr. = .015 Gm.

Convert 7/8 grain to Metric System.

$$7/8 \text{ gr.} = 7/8 \times .067 \text{ Gm.} = \frac{7 \times .067}{8} = .058 \text{ Gm.}$$

7/8 gr. = .058 Gm.

Convert 1/150 grain to grams.

$$1/150 \text{ gr.} = 1/150 \times .067 = \frac{.067}{150} = .0004 \text{ Gm.}$$

Convert 5 grains to Metric System.

5 gr. = 5 x .06 Gm. = .30 Gm. or .3 Gm.